GLOBE '90

CONFERENCE

ABSTRACTS

(presented in the language in which they were submitted)

RÉSUMÉS D'EXPOSÉS

DE LA

CONFÉRENCE DE GLOBE 90

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ABSTRACTS

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STREAM B1
POLICY AND LEGISLATION

BACON, Michael K. Environmental Resources Management - Northwest
2821 Northup Way, Bellevue, U.S.A., 98004; (206) 827-9440

WASTE MINIMIZATION: GOALS AND STRATEGIES

Waste minimization carries different meanings in different contexts, from eliminating the source of waste generation totally to minimizing the toxicity and risks posed by wastes that are generated. Policy makers are attempting to encourage waste minimization through a number of alternative strategies with mixed success. Negative strategies, such as taxes on waste generation, mandatory waste reduction, and restrictions of specific waste management techniques contrast with positive strategies, such as technical assistance programs, waste reduction work shops and training centres. This paper examines the efficiency and efficacy of each strategy relative to different factors.

BARICH, John III U.S. Environmental Protection Agency
E.P.A. Region 10, 1200 6th Avenue, Seattle, U.S.A., 98101; (206) 442-8562

MATCHING CLEANUP TECHNOLOGIES TO STANDARDS ON A SITE-BY-SITE BASIS

Environmental standards are inoperable until translated into site specific action. The degree to which contaminated sites must be restored is determined by performed goals deriving from broad, national standards, or resource and risk assessment analysis. While standards may be simple to administer, goals based on resource and risk assessments are much more likely to be cost effective. When translating standards into action, the interplay of tests, measurements, and compliance points introduces a varied ability. Local conditions and the skills of the problem solving team may be more instrumental in the success of a restoration project than are the standards themselves.

CHANT, Donald A. Ontario Waste Management Corporation
11th Floor, 2 Bloor St. W., Toronto, Canada, M4W 3E2; (416) 923-2918

FUTURE DIRECTION WITH RESPECT TO INDUSTRIAL WASTE

People in most countries around the world are expressing deep concern over contamination of the environment by toxic industrial wastes and direct threats to human health. In most highly industrialized countries political action is resulting in much tougher policies and in legislation to require the three R's of industrial waste management - reduction, recovery and recycling, as well as treatment and disposal using the best available technologies. Many less highly industrialized jurisdictions are attempting to do the same and to avoid the mistakes of the highly industrialized countries. In addition to rigorous action to manage these wastes within each jurisdiction, the future also will see tough action at the international level, particularly with regard to transboundary pollution and global resources related to the oceans and the atmosphere.

DIAS, Clarence International Centre for Law in Development
777 United Nations Plaza, New York, U.S.A. 10017; (212) 687-0037

COPING WITH MULTI-JURISDICTIONAL ISSUES LESSONS FROM BHOPAL

It is now 4 1/2 years since the world's worst industrial disaster in Bhopal and the litigation is still very much in progress. This presentation reviews the lessons learned about multi-jurisdictional problems from the Bhopal litigation. Issues discussed include "forum dodging", conflicting legal theories of causation and varying bases for opposing liability, and issues relating to recognition and enforcement of foreign decrees. Also examined are three innovative responses (interim relief, absolute liability, and multi-national enterprise liability) growing out of the Bhopal experience which can help hold multi-national corporations accountable for the causing of trans-boundary human and environmental harms.

ERASMUS, Georges Assembly of First Nations
#300 - 43 Clarence St., Ottawa, Canada, K1N 9K1; (613) 236-0673

SUSTAINABLE DEVELOPMENT: RHETORIC OR REALITY?

This paper suggests that indigenous peoples practised sustainable development in North America for thousands of years before the arrival of the Europeans. The fact that the natural environment is now so seriously threatened in North America and throughout the globe is largely because indigenous people have been prevented from playing a meaningful role in environmental management and resource development. If non-indigenous governments and the corporate sector are truly serious about pursuing development strategy based on sustainable development, then they need to recognize that indigenous peoples and indigenous governments have an essential role to play.

FOWLER, Robert J. Faculty of Law, University of Adelaide
G.P.O. Box 498, Adelaide, Australia, 5001; (618) 228-5582

COMPARATIVE ANALYSIS OF LIABILITY FOR ENVIRONMENTAL DAMAGE

Liability for environmental damage may be civil or criminal. Provisions and environmental legislation frequently enable civil action for the recovery of clean up costs associated with environmental accidents. In addition, both statutory and legal remedies are available to those who suffer damage, or economic loss, as a result of such accidents. Difficulties in pursuing such remedies are considered as is the problem of offenders having insufficient financial resources. Various schemes for liabilities are described in this paper including measures employed in North America and Australia. The second part of this presentation deals with criminal sanctions such as imprisonment, substantial financial penalties and community service orders which may be aimed at the directors of vending corporations.

GOW, Lindsay J.A. Ministry for Environment, Government of New Zealand
P.O. Box 10362, Wellington, New Zealand; (64) 4-734-090

NEW ZEALAND'S RESOURCE MANAGEMENT AND LOCAL GOVERNMENT REFORMS

New Zealand has undertaken two major and fundamental reforms affecting resource management and local government. The Resource Management Law Reform provides for management of land, air, water, minerals, pollution, hazardous substances, the coast, and the built environment to be integrated and to operate within a common and consistent legal framework based on the principle of sustainable management. The reforms have also resulted in a radical reorganization of local government. A plethora of over eight hundred authorities has been reduced to less than one hundred operating at two levels: regional and district. This paper outiines the approach to a process adopted for the reviews and deals with some of its implications.

GRIFFITH, Carl Minitry of Environment, Province of Ontario
11th Floor, 135 Saint Clair Avenue West, Toronto, Canada, M4V 1P5; (416) 323-4581

FINANCIAL ASSURANCE - A NEW TOOL FOR PROMOTING SUSTAINABLE DEVELOPMENT

Compliance with pollution controls and environmental protection requirements is an important aspect of sustainable development. Governments must, therefore, be apprised of policy tools that can help induce regulated parties to implement agreed-to control programs in a timely manner. This paper describes the origins and features of the new policy tool that is unique to Ontario.

HTUN, Nay Regional Office for Asia and the Pacific, United Nations Environment Program
U.N. Building, Rajadamnern Avenue, Bangkok, Thailand, 10200; 2829161-200

INSTITUTIONAL OPPORTUNITIES AND CONSTRAINTS TO SUSTAINABLE DEVELOPMENT

This paper reviews the major technical, ecological, social and environmental factors that contribute to the promotion of sustainable and environmentally sound developments. It also discusses the institutional factors that affect the planning and implementation of sustainable development policies. The paper concludes by suggesting measures that could reduce institutional constraints to promote the integration of environment and development policies.

HUMMEL, Blaine Environmental Resources Management Inc.
Carnegie Professional Building, Suite 204, 100 Canal Pointe Boulevard, Princeton U.S.A. 08540; (609) 520-8779

ENVIRONMENTAL AUDITS OF INTERNATIONAL INDUSTRIAL FACILITIES

Governments are responding to public demands that industries be held accountable for their contribution to environmental degradation by establishing standard federal policies and threshold levels for pollutants, while acting and enforcing stricter penalties for non-compliance. Increasingly, environmental auditing in used by U.S. industry to assess the compliance with federal and state environmental regulations. Such audits not only prevent possible future penalties for regulatory non-compliance, but reduce the potential environmental health hazard liabilities associated with certain industrial activities. This presentation discusses some of the international and environmental audit programs in Europe and Latin American which incorporate environmental, health and safety policies and procedures and, regulatory requirements. The U.S. environmental regulatory experience and standards are highlighted.

JACKSON, Donald K. Laidlaw Inc.
3221 North Service Rd., P.O. Box 5028, Burlington, Canada, L7R 3Y8; (416) 336-1800

FISCAL INCENTIVES AS POLICY INSTRUMENTS

The issue of fiscal incentives or disincentives is a new policy area as it applies to the waste management industry in Canada. Briefly overviewed, the Canadian context differs from province to province as does the size and maturity of the waste management industry. A discussion of incentives is provided and conclusions are drawn about the future development of the Canadian industry as an important growing sector of the economy.

JENKINS, Bryan Kinhill Engineers Pty. Ltd. and Institution of Engineers of Australia
200 East Terrace, Adelaide, Australia (61) 8-223-7011

NATIONAL POLICY ON SUSTAINABLE DEVELOPMENT OF THE INSTITUTION OF ENGINEERS, AUSTRALIA

Development is sustainable when it can continue to provide social and economic benefits without significant environmental degradation and resource depletion for as long as the benefits are required. The application of the principles of sustainable development will change the practice of engineering. As an initial step to make the engineering professional aware of the changes inherent in sustainable development, the Institution of Engineers of Australia has prepared a National Policy On Sustainable Development. This policy is supported by a discussion paper and sets out the need for sustainable development objectives and a strategy for implementation.

JENNINGS, John R.R. Canadian Bar Association
Suite 902, 50 O'Connor Street, Ottawa Canada, K1P 8L3: (613) 237-2925

INTERNATIONAL TRENDS POLICY AND LEGISLATION

The Brundtland Report provides us with a comprehensive account of many of the current environment problems facing us, but few specific recommendations for reform. However, it is clear that law reforms will be required to aid in implementing the principles contained in the Brundtland Report. At its annual general meeting in August 1989, the Canadian Bar Association confirmed a strong commitment to promoting sustainable development in Canada. CBA president, John Jennings, Q.C. will outline the Sustainable Development Action Plan initiated by the CBA, highlighting the law reform and recycling components of the program.

JONES, Shane Government of New Zealand, Ministry of the Environment
P.O. Box 10362 Wellington New Zealand (04) 734090

CURRENT ISSUES BETWEEN INDIGENOUS PEOPLES AND THE NEW ZEALAND GOVERNMENT

This paper is an examination of critical issues between Iwi Maori, Maori tribes, and the Labour Government of New Zealand. It covers the new Resources Management Bill which has sustainable management as it cornerstone. Over the past two years the new New Zealand Labour Government has attempted to implement a policy of deviation for Maori tribes, particularly as it pertains to economic development. This paper provides current information and a range of Maori insight into this process.

LESH, Donald, R. Global Tomorrow Coalition
1325 G. Street N.W., Suite 915, Washington D.C., 20005 - 3104 U.S.A.; (202) 628-4016

U.S. POLICY AND LEGISLATION: BUILDING CONSENSUS FOR SUSTAINABLE DEVELOPMENT

Indictors of growing U.S. engagement with the action and policy implications of the concept of sustainable development may be found in sectors of business, education, law, religion, civic and service organizations, communication media, and governments at the local, state, regional, and national levels. An important catalyst in this process has been the Globescope Pacific Assembly organized by the Global Tomorrow Coalition in Los Angeles, California, in November 1989, and the related national wide follow up activities of the GTC. Still unclear is the extent to which the United States will provide active and positive international leadership for the 1992 United Nations Conference On Environment And Development In Brazil.

MACDONALD STEWART, Howard Environment Professional Services Branch, Canadian International Development Agency
200 Promenade Du Portage, Hull, Canada, K1A 0G4; (819) 997-0477

CANADIAN ENVIRONMENTAL STANDARDS IN THE GLOBAL CONTEXT

The Canadian International Development Agency (CIDA) serves as a bridge between rich and poor countries. However, while the wealthier developed countries continue to operate under lax environmental standards themselves, there is little evidence to suggest that assistance policies and dialogue with developing nations are being taken seriously in properly addressing the larger issues of global warming and ozone depletion. There is little direction or incentive for developing nations to implement environmentally responsible practices. China, Brazil, India, and Mexico - to name a few - have economic growth rates that are rapidly making them important contributors to environmental degradation. Only by setting high standards ourselves can we hope to convince all nations of our collective responsibility.

MAY, Elizabeth Cultural Survival (Canada)
#420 - 1 Nicholas St., Ottawa, Canada, K1N 7B7; (613) 233-4653

THE RAFFERTY\ALAMEDA EXPERIENCE - A CASE STUDY IN THE PUBLIC ROLE ON POLICY

The Canadian Rafferty\Alameda River Diversion and Major Hydro Electric Development Project provides a very revealing case study of the role of public influence in forming Canadian, Provincial and Federal policy. This presentation reviews the Rafferty issues, discusses reasons for two court challenges and how the controversy may or may not have an impact on a long-promised Federal Environmental Assessment for the development project. The discussion highlights the public role in policy development and implementation.

MCCAFFREY, Stephen C. McGeorge Law School, University of the Pacific
3200 5th Ave., Sacremento, U.S.A., 95818; (916) 739-7179

GOVERNMENTAL PERSPECTIVES ON INTERNATIONAL LAW AND LEGAL TOOLS

The international legal framework, as it relates to transnational emergencies, is only beginning to be constructed and as such, remains inadequate to prevent, mitigate and provide relief to those harmed by such incidents. The decade of the 80's witnessed a number of major disasters caused by human activity, including Bhopal, Chernobyl, the Rhine Chemical Spill, and massive oil spills off the coasts of Alaska and Morocco. While the international community has attempted to respond to these kinds of events, the approach remains more reactive then preventative. Existing law and current efforts to fashion new approaches are reviewed.

MCKAY Alvin Nishga'a Tribal Council
General Delivery, New Aiyansh, Canada, V0J 1A0; (604) 633-2234

NISHGA'A LAND QUESTION

The packages for the agreements of the Nishga'a Land Claims Negotiations are being put together with the full realization that a pollution-free environment, substantiable harvesting methods and integrated land and resource management schemes have to be major ingredients in order that the Nisga'a Nation achieve their forefathers' philosophy that the lives are inseparable from the land and the resources. This presentation discusses these objectives and aspirations of the Nisga'a.

MEUNIER, Pierre B. Martineau Walker
3400 The Stock Exchange Tower, P.O. Box 242, Place Victoria, Montreal, Canada, H4Z 1E9; (514) 397-4380

THE QUEBEC FUND FOR RECUPERATION: A NEW AND "RECOVERABLE" EXPERIENCE

This presentation commences with an historical account of The Government of Quebec's imposition of a fee on beer and soft drink non-refillable containers and the introduction of recyclable containers between 1976 and 1984. The fee resulted in an agreement to return and recycle new containers. This process encountered some difficulties in the beginning, and the presentation describes the participants, the enabling laws, the agreements and the creation of enabling fund. The paper concludes with an assessment of future directions and implications for curb side collection and industrial recycling of tires and batteries.

MUNRO, Jack IWA - Canada
500 1285 West Pender, Vancouver, Canada, V6E 4B2; (604) 683-1117

CHANGING PUBLIC POLICY AS A PROVISION FOR AN "EQUAL OPPORTUNITY" SOCIETY

This presentation centres on various aspects of public policy, notably interest rates, education and housing policy, which have to be altered to provide for an open "equal opportunity" society as the environmental conservation imperatives are woven into Canadian legislation and policy. The discussion invokes the Brundtland Commission's emphasis upon the need for international equity into the national (Canadian) scene.

PERCY, Dave R. University of Alberta, Faculty of Law
4th Floor, Edmonton, Canada, T6G 2H5 (403) 492-3115

COPING WITH MULTI-JURISDICTIONAL ISSUES

This paper deals with the experience of implementing environment policies in federal states, with some contrasts to the problems faced by unitary states in Western Europe. Federalism was traditionally seen by environmental groups as an inconvenient obstacle to the maximum of necessarily legislation. Initially, this obstacle was partially overcome by development of cooperation between the central and local governments, but recently the environment has appeared to tilt the balance of legislative power in Canada, Australia and the United States towards the federal government. Nevertheless, federal states, in contrast to unitary states where they implementation of environmental policy is structurally earlier, have tended to encourage the development of innovative solutions and to deal better with localize problems that do not always command the attention of the central government.

RANKIN, Murray Faculty of Law, University of Victoria
P.O. Box 2400, Victoria, Canada, V8W 3H7; (604) 721-8150

NEW TRENDS IN ENFORCEMENT: ECONOMIC SANCTIONS AND REWARDS

There is a trend in several jurisdictions to alter the traditional "command and control" approach taken in the enforcement of environmental legislation. Increasingly, regulators are attempting to tie environmentally dilatory behaviour to sanctions and rewards that have clear and immediate economic impact. These trends are canvassed and evaluated, with several recommendations offered.

RASILE, John Environmental Services Division, Fluor Danial Inc.
3333 Michaelson Ave., Irvine, U.S.A., 92730; (714) 975-2610

EMERGING TRENDS IN INTERNATIONAL ENVIRONMENTAL POLICY AND LEGISLATION

Environmental Regulations and Policy are evolving throughout the world. Some nations have developed and implemented intricate environmental programs and are now concentrating on compliance and enforcement in addition to research into new topics of concern. Other nations are struggling with the difficult tasks of balancing economic development and social issues with environmental protection programs and the complex infrastructures necessary to support environmental protection. This presentation highlights some of the major emerging international environmental trends and identifies initial issues for thought.

RUBY, P.M. (Pat) Amoco Canada
11th Floor, 240 4th Avenue South West, Calgary, Canada, T2P 4H4; (403) 233-1433

EXCHANGE AND ADAPTATION "ABORIGINAL COMMUNITY AND HYDROCARBON DEVELOPERS IN NORTHERN CANADA"

This presentation focuses on the nature and influence of aboriginal roles in hydrocarbon development in Northern Canada in the last decade and half, with partial reference to Amoco Canada's experience in four different geographic areas in Alberta and the Northwest Territories. Review of these experiences is followed by observation about learning which is resulted from exchanges among hydrocarbon companies and aboriginal communities. This than raises some broad questions about possible future opportunities for mutual learning to meet environmental, social and economic challenges.

RUTHERFORD, Paul Australian Conservation Foundation
G.P.O. Box 2699, Canberra, Australia, 2601; (61) 3-416-1455

THE ROLE OF COMMUNITY GROUPS IN THE MOVE TO SUSTAINABLE DEVELOPMENT: AN AUSTRALIAN PERSPECTIVE

Australia has now become locked in a vigorous debate concerning the concept of the sustainable society, focusing on the Brundtland Report. The Australian Conservation Foundation has now formulated a thirty year master plan aimed at taking the work of the organization towards this objective in three major areas:

1) biodiversity and the continuation of naturally existing species; and
2) global change and the issues of greenhouse and ozone depletion; and
3) natural resources and their use on a sustainable basis.

In a different area the foundation has now formed an alliance with the NATIONAL FARMERS' FEDERATION, creating the largest agricultural lobby to move the Federal Government toward a commitment over the next decade to turn around the enormous problem of land degradation in Australia. The paper concludes by highlighting some of the non-governmental organization's specific campaign initiatives.

SIMON, Mary Inuit Circumpolar Conference
#404 - 650 32nd Avenue, Lachine, Canada, H8T 1Y4; (514) 637-3771

ROLE OF INDIGENOUS PEOPLES IN ENVIRONMENT-RELATED ISSUES: AN INUIT PERSPECTIVE

This presentation focuses on the need for a direct and meaningful role for indigenous peoples in relation to environmental and development issues in or affecting their territories. Particular attention is given to Inuit and Arctic-related issues. In terms of specific matters, the need for sustainable and equitable development and the emerging human right to development is addressed. In this context, new environmental initiatives as well as current problems relevant to the north are briefly discussed. The transitional transnational Inuit Regional Conservation Strategy (being undertaken by the Inuit Circumpolar Conference) is also highlighted.

STREAM B1: POLICY AND LEGISLATION

SIPPE, Robert Environmental Protection Authority of Western Australia
1 Mount Street, Perth, Australia, 6000

TOWARD SUSTAINABLE DEVELOPMENT IN WESTERN AUSTRALIA

While Western Australia has many features in common with underdeveloped nations, it also has well developed educational and technical capabilities and strong democratic traditions. This combination makes the Western Australian approach to sustainable development unique. The state shares the struggle to improve the benefits it gains from exploitation of its resource heritage and the state's residents enjoy unparalleled freedom to experiment, innovate and adapt technology and social structures to achieve greater equity in wealth and power. Success in these programs has:

1) rehabilitated badly eroded and saline agricultural lands;
2) established small businesses in which local control, initiative, ingenuity, and resource processing are paramount; and
3) developed a range of innovative products ranging from chloroflorocarbon processing units to highly efficient engine design.

UMEZAKI, Yoshimi Industrial Pollution Control Association of Japan
Shuwa Toranomon #3, Building 21-8 Toranomon 1 Chome, Minato-Ku, Tokyo, Japan 105; (81) 3-580-8808

EDUCATION AND TRAINING SYSTEM IN POLLUTION CONTROL IN JAPAN

Beginning in the 60's environment pollution became a major issue in Japan. Due to the strenuous pollution abatement efforts exerted in subsequent years by the government as well as private sector, Japan has become one of the "worlds most advanced countries in environment protection". One of the specific considerations was the involvement of "pollution control managers" authorized by the Law for Establishment of Organization for Pollution Control in Specified Factories. These nationally-qualified individuals now total some 390,000 persons over the past 19 years. This presentation details some of the activities of IPCAJ, a private but nonprofit organization under the supervision of MITI.

REGULATING RISK PANEL

CHAIRMAN: MURRAY, Robert International Commission on Occupation Health
1 South Dean Park Avenue, Bothwell, Lanarkshire, United Kingdom, G71 HC5; 44-698-852422

THE KEY QUESTIONS AND HISTORICAL ANECDOTES

What is a risk versus a hazard? This panel will discuss decisions to regulate and set standards, problems of monitoring and control, and problems of communicating and educating the public of risks. Dr. Murray will draw on his experience and occupational environmental health to provide an overview based on historical annecdotes.

BURTON, Ian The International Federation of Institutes for Advance Study
560 Hillsdale Road, Ottawa, Canada, K1M 0S1; (613) 994-5166

ISSUES IN REGULATING RISK

Dr. Burton will discuss evidence of risk (to whom or what); analysis and evaluation of risks; options available - role of self regulation, codes of practice incentives versus sanctions; decision making; consequences and politics of risk, and risk perceptions. Dr. Burton will explain the main concepts and raise key questions, including the trans-boundary nature of risks and of regulations and standards.

DOLL, Sir Richard Oxford University, ImperialCancer Research Fund
65 Banbury Road, Oxford, England; (44) 865-57241

THE SCIENITIST'S ROLE IN INFLUENCING POLICY AND REGULATION OF RISK

Sir Richard will discuss the complexity of data, extrapolating from animals to man and from a situation of high dose to low dose; the scientific ethic versus the politic necessity, particularly in developing countries, using examples, including WHO experts, consultation on asbestos, and issues relating to heavy metals.

MAYUR, Rashmi Global Future Network
73 A Mittal Tower, Nariman Point, Bombay India 400021; 91-22-204-5758

THE MANAGEMENT OF REGULATED RISKS IN LESSER DEVELOPED COUNTRIES

Dr. Mayur will discuss the importance of scientific information in assessment of relativity of risks, the costs and benefits, values and technology difference, product and stewartship (that is, the necessity of information, training and technology transfer along with the products) using examples from Bhopal and Chernobyl.

STREAM B2
BUSINESS DEVELOPMENT

BARTELMUS, Peter Environment Statistics Section, Statistics Development Office, United Nations
Room 0C2-16-52, New York, U.S.A. 10044; (212) 963-4581

NATURAL RESOURCES AND ENVIRONMENTAL ACCOUNTING

Environmental accounting aims at the incorporation of the costs and benefits of natural resource depletion, environment quality degradation, and environment protection activities into conventional accounting. The inclusion of these costs and benefits permits the compilation of environmentally adjusted indicators of capital, income and expenditure, value added, and their components. The Statistical Office of the United Nations is currently developing the methodologies of integrated environmental - economic accounting in physical and monetary terms within the framework of the United Nations System of National Accounts.

BELL, Larry B.C. Hydro
21st Floor, 970 Burrard Street, Vancouver, Canada, V6Z 1Y3; (604) 663-3380

BUSINESS AND SUSTAINABLE GROWTH

The present population of the world is expanding at an increasing rate, and this growth is being supported by the depletion of our most precious natural resources. The resources of most concern are referred to in general as the global common, and include the atmosphere, oceans, fisheries, fresh water and land in public ownership. Science provides many technical solutions to these problems, but new and innovative ideas such as assimilative capacity indicators are required. Economic theory must also change to encompass the true value of goods produced, and as well provide a closer link between growth and development and environmental health. The movement toward understanding the limits of our natural system and sustainable growth provides new and challenging opportunities. A critical step in this process is the important contributions that can be made by businesses and individuals.

CARROLL, David W. LaFarge Corporation
P.O. Box 4600, Reston, Virginia, U.S.A; (703) 264-3600

POLLUTION PREVENTION - A CHEMICAL INDUSTRY PROSPECTIVE

The subject presentation addresses pollution prevention from a chemical industry perspective. The initial focus of the presentation will be on the primary driving forces behind pollution prevention. This analysis addresses economics, reduction in liability exposure, public relations, and recent submittal of environmental release data under section 313 of the Super Fund Amendments and Re-authorization Acts. The presentation focuses on several CMA programmes directly associated with multi-media pollution preventions, control, and reduction - CMA's Waste Minimization, Air Quality, Title 3, Chemical Release Reduction, and Responsible Care Programme. The final portion of the paper summarizes various CMA reports and analyses that indicate that the chemical industry is making ongoing progress in reducing its environmental releases with respect to air, water and solid waste.

CONNELL, Martin P. The Calmeadow Charitable Foundation
95 Wellington Street West, Suite 2000, Toronto, Canada; (416) 362-6721

THE ROLE OF "SOURCES OF CREDIT" IN SELF-EMPLOYMENT

Economic development practitioners in the developing and developed world increasingly recognize that support for self-employment is a viable option for job creation and income generation for the least economically advantaged. With over one third of the world's population dependent upon income derived from self-employment, or micro enterprise, and with new global job seekers of 150,000 per day, the importance of developing targeted programs of assistance has never been more relevant. Affordable and sustainable sources of credit is considered an essential component of all self-employment strategies.

DELBRIDGE, Pat Environmental Choice Program
101 Atlantic Avenue, 3rd Floor, Toronto, Canada, M6K 1X9; (416) 532-6966

MARKET OPPORTUNITIES - THE ENVIRONMENTAL CHOICE PROGRAM

More than twenty countries around the world are now considering implementing ECO-LOGO programs that provide scientific verification of what makes a green product green. The Canadian program has been used as a model in planning these initiatives. This paper describes the difficult trade-offs that had to be made in applying a cradle-to-the grave approach to product and service selection. The approach taken by the Board of Environmental Choice Program and the decisions taken to date are discussed in light of their influence on market opportunities in the 1990's.

HAMILTON, Kirk Environment and Natural Resources Section, Statistics Canada, Government of Canada
24th Floor, Coates Building, Ottawa, Canada K1A 0T6; (613) 951-8585

THE ECONOMY AND THE ENVIRONMENT: CAN THEY BE COMPATIBLE? NATURAL RESOURCE AND ENVIRONMENTAL ACCOUNTING

There are many criticisms of the System of National Accounts (SNA) from an environmental perspective. One of the most telling for the environmental analyst is the inability to determine from the accounts whether the economy is developing sustainably. National Resource Accounting offers the possibility of bringing the effects of environmental degradation and resource depletion into the SNA. Some of the technical issues involved in doing this include the measurement of resource extent and evaluation of resources.

KENNEY-WALLACE, Geraldine A. Science Council of Canada
100 Metcalfe Street, 17th Floor, Ottawa, Canada K1P 5M1; (613) 992-2097

THE ROLE OF CANADA AS "ENVIRONMENTAL PEACE KEEPERS"

Whether in defence of the planet or peace, Canada should continue to lead as "environmental peace keepers". Global environmental problems are serious and require a mix of local actions and strategic alliances to ensure results. The challenge to foreign policy initiatives as markets open up (whether in the Pacific and Eastern Europe or in still developing countries) is to ensure that the environment and the economy are compatible and science and technology are part of the solution. From the world bank to foreign aid and multi national investments in a rapidly decentralizing global village market, energy, education, ethics and environments are the keys to compatibility.

LENTS, James South Coast Air Quality Management District
9150 Flair Drive, Elmonte, U.S.A., 91731; (818) 572-6200

GOVERNMENT REGULATION AND OPPORTUNITIES FOR NEW TECHNOLOGY

This paper discusses the Air Quality Management Plan, a regional road map on which the Los Angeles Basin can meet federal and even tougher state air quality standards by the year 2000. The author also discusses the District's Technology Advancement Office, which promotes the development, demonstration and commercialization of innovative emissions control technology. Finally, the market for these new technologies in Southern California is discussed.

LIN, C.M. Hong Kong Productivity Council
Environmental Management Division, 12th Floor, World Commerce Centre, 11 Canton Road, Tsimshatsui, Kowloon, Hong Kong; (852) 362-4351

APPROACHES IN HELPING SMALL AND MEDIUM INDUSTRIAL OPERATIONS IN POLLUTION CONTROL

Hong Kong is a densely populated city with many thousands of small and medium industrial operations encroaching upon the residential areas. Many of these operations could easily give rise to air, water and noise pollution if control measures are not adequately exercised. In response to this the Hong Kong government is tightening its environmental legislation. The Hong Kong government established an Environmental Management Division ten years ago to provide low cost environmental consultancy service to small and medium industrial operations. This presentation discusses the procedures and the format used by the Division in assisting these industrial businesses.

MILLER, Doug Synergistics Consulting Limited
4th Floor, 54 Berkeley Street, Toronto, Canada M5A 2W4; (416) 366-3083

CHANGING PUBLIC VALUES: IMPLICATIONS FOR BUSINESS IN THE 1990'S

A new environmental activism springing from a planetary concern for ecological protection is not a aberration or a passing phase-it is quickly establishing itself as normative behaviour in a number of countries. Because it is rooted in health fears, it is capable of weathering economic downturns and driving a decade of change. Out of all this, a new breed of environmental consumers is emerging, voting at the cash register and being heard in the board room. This presentation explores the dimensions and future directions of this environmental consumerism. It outlines how micro-levels, product innovations and changes in business practise are being perceived in public. It identifies macro changes in the offing, and it presents immediate business opportunity. Finally, it foreshadows the mega-opportunities that promise mega rewards to those countries and nations with the vision and the wish to pursue them.

NELSON, Gaylord The Wilderness Society
10th Floor, 1400 Eye Street, Northwest, Washington, USA 20005; (202) 842-3400

A CLEAN ENVIRONMENT AND A PROSPEROUS ECONOMY: CAN WE HAVE BOTH?

Those who use the cost benefit assessment to weaken support for environmental mandates do not include in their assessments all societal costs and benefits, only those that are easily quantifiable in current dollar costs to the polluter and measurable on a consumer price index. In their computations they do not include the societal cost of a polluted river, a lake or forest destroyed by acid rain, or poisoned by toxic chemicals, a wild life refuge destroyed by selenium or any one of dozens of societal costs. If all costs and benefits are included, the case is clear beyond question that preserving a clean environment is a profitable investment. This presentation discusses the inclusion of all societal costs in the cost benefit formula.

O'NEILL, Frank Vancouver International Airport
P.O. Box 23750, Airpost Outlet, Richmond, Canada V7B 1Y7; (604) 276-6208

IMPLEMENTING A COMPREHENSIVE ENVIRONMENTAL PROGRAM IN A LARGE ORGANIZATION

Vancouver International Airport, like all international airports, is a small industrial city unto itself. The airport employs 14,000 people in industrial, commercial, technical and administrative capacities. The challenge in implementing stricter environmental practises into the operations of the current plant and into the designs of the new facilities begins with establishing and then continuing open lines of communication with the environmental agencies and community groups. This paper focuses on the challenges and opportunities the Vancouver International Airport faces in the development and implementation of a comprehensive environmental program.

REYNOLDS, The Honourable John Ministry of Environment, Government of British Columbia
Victoria, Canada, V8V 1X4

BUILDING AN ENVIRONMENTAL INDUSTRY

Public concern and the reality of local and global environmental threats have made sustainable development a market place imperative. Prevention of environmental impacts is less costly than repairing the damage, and must be built into the design of new developments, as well as the upgrading of existing operations. For British Columbia, the development application of environmental technology will provide new business opportunities, assist in diversifying the province as an industrial base, and help to meet the environmental challenges of the coming century.

SCOTT, David S. Centre for Integrated Energy Systems, University of Victoria
Victoria, Canada, V8W 2Y2; (604) 721 8931

OUR MATURING ENERGY SYSTEM: BUSINESS IMPLICATIONS TO 2020

Two issues will profoundly shape the next half century: first, the prospect that anthropogenic climate instabilities (primarily caused by emissions from the energy sector) might disrupt the development of civilization; second, the need for energy services provided by maturing energy systems that reduce (and later eliminate) climatic risk. This paper discusses the linkage between these two issues, and how this linkage will shape our maturing energy system. The focus is on identifying strategies for
1) business interruption insurance
2) business development positioning.

STEPHENSON, Derek Resource Integration Systems
2-400 Mount Pleasant Road, Toronto, Canada, M4S 2L6; (416) 480-2420

BUSINESS SUCCESS IN THE ENVIRONMENTAL DECADE

Most businesses now recognize that the environment is an important issue, but very few understand the profound impact of widespread environmental consciousness; or the scope of change that is now under way. This presentation looks at the growing tide of environmental awareness and its implications for business. It explores some of the major environmental opportunities that will emerge in the 1990's and assesses some of the risks facing companies operating in an environmentally conscious marketplace. It concludes by suggesting specific steps that businesses can take to survive and succeed in the upcoming environmental decade.

VAN SETERS, David Peat Marwick Stevenson & Kellogg
P.O. Box 11183, Royal Centre Suite 200, 1055 West Georgia Street, Vancouver, Canada V6E 2L1; (604) 662-5602

ENVIRONMENTAL BUSINESS OPPORTUNITIES IN NORTH AMERICA

This presentation describes the significant size and growth rates of the five major environmental markets in North America: air, water, land, solid waste, and hazardous waste management. Total market size is compared with other industry sectors and other geographic regions. Major business opportunities available in each market are also discussed. Some newly emerging environmental opportunities in business sectors not typically associated with the environment industry are further introduced.

WARFORD, Jeremy World Bank
1818 H Street North West, Washington, U.S.A. 20433; (202) 473-3299

WORLD BANK'S ENVIRONMENTAL POLICY

This presentation reviews the recent evolution in the World Bank's environmental policy, which stresses integration of the environment into all aspects of the bank's work, particularly its macro-economic work. The World Bank's procedures and future agenda are also described.

STREAM B3
TECHNOLOGY AND RESEARCH

BASER, Robert V. Communications Development, Department of Communications, Government of Canada
300 Slater Street, Journal Tower North, Ottawa, Canada, K1A 0C8; (613) 990-4112

COMMUNICATIONS TECHNOLOGY AND ENVIRONMENTAL PROTECTION

Communications and informations technologies have a vital role to play in supporting sustainable development while minimizing detrimental effects on the environment. Communications technologies are "clean technologies", consume few of the Earth's resources and are essential to continuing economic development throughout the world. Communications technologies offer opportunities to "buy time" in the near term to reorient the economic infrastructure of the industrialized world to a sustainable equilibrium. This presentation explores how communications and information technologies can effectively reduce dependence on transportation facilities, reduce paper usage, be an effective tool in improving resource management, industrial commercial processes, energy reduction, and in responding to environmental disasters, as well as be a publicity tool to raise awareness and promote sustainable development programs.

BERG, David R. United States Environmental Protection Agency
Office of Cooperative Environmental Management, Washington, D.C., 20460; (202) 382-3153

TECHNOLOGY INNOVATION FOR ENVIRONMENTAL PURPOSES

Early U.S. environmental strategies, which have primarily employed a "command and control" based philosophy to motivate behaviour by environmental participants, have had considerable success. Motivating voluntary cooperation and collaboration between regulators, the regulated, the public and others will be needed as well, however, to respond to the greater environmental challenges of the 1990s. Successful environmental solutions in this next decade will apply innovative technologies that offer greater environmental benefits and efficiencies in the production of goods and services. To obtain such a positive technology response will require system rethinking of environmental strategies to create opportunities to test, demonstrate and commercialize promising new technology. It will also require environmental professionals and investors to recognize their self interest in leaveraging the creative efforts of potential partners to the end of sustainable development.

BORGESE, Elizabeth Mann Pearson Institute, Dalhousie University
1325 Edward Street, Halifax, Canada, B3H 3S5; (902) 424-2034

PROPOSAL AND FEASIBILITY PLAN FOR THE MEDITERRANEAN CENTRE FOR RESEARCH AND DEVELOPMENT IN MARINE INDUSTRIAL TECHNOLOGY

The 1982 United Nations' Convention on the Law of the Sea prescribes the establishment of regional centres to enhance marine sciences and technology, especially in regions of developing countries. The author reports on a couple of initiatives the Institute has taken to implement these provisions. Their proposal, which was launched in the Mediterranean and the Caribbean, in corporation with UNEP, UNIDO and UNESCO/IOC anticipates the "Ocean Enterprise" model and is based on the most advanced concepts of public/private cooperation at the international level.

CARPENTER, Les Inuit Circumpolar Conference of Canada
c/o Nancy Doubleday, 170 Laurier Avenue, Suite 510, Ottawa, Canada, K1V 5V5;
(613) 563-2642

AN INUIT CIRCUMPOLAR PERSPECTIVE ON RESEARCH AND TECHNOLOGY NEEDS TO SUPPORT SUSTAINABLE DEVELOPMENT

To date, scientific research in the Circumpolar region has been done primarily to address interests in specific sectors by and for non-arctic societies. These research interests have been driven by events and concerns linked to global considerations such as the oil crisis precipitated by OPEC activities. However, if we are to move to a context where criterion of sustanability and equity become determinants with respect to development decisions, a different process driving different programs of scientific research and different types of technological innovation will be required. This presentation deals with some of these new methods and processes that are being suggested and recommended and which will include the Inuit and other northern peoples.

DENIS, Jacques IFREMER
66 Avenue d'Iena, Paris, 75116, France; 47235528

SPACE REMOTE SENSING CONTRIBUTION (SPOT) FOR POLLUTION PLANNING CONTROL

The threat of pollution amplifies the need for detailed knowledge of the coastal environment. The Earth observation satellite 'SPOT' is a well adapted tool to perform such studies, thanks to digital image processing methodologies. The entire information is compiled on thematic cartographies which display various sensitivity levels ranked on an "environmental sensitivity index". Such documents constitute a coastal atlas which contributes to decision making and to the development of strategies regarding shoreline protection and cleanup or logistics. SPOT imagery is now an operational alternative to traditional methods for environmental surveys devoted to contingency planning.

DREWRY, David J. British Antarctic Survey, Natural Environmental Research Council
High Cross, Madingley Road, Cambridge, England, CB3 0ET; 223-61188

THE CRYOSPHERE AND CLIMATE: REMOTE SENSING PRIORITIES FOR THE 1990's

The cryosphere is coupled closely with climate. Changes in snow and ice extent alter the Earth's albedo and consequently the hemispheric radiation budgets which drive the atmospheric engine. They also influence a transfer of energy, mass and momentum between land, sea and the atmosphere, and control weather patterns on a variety of spatial and temporal scales. Sea ice and ice shelf processes influence ocean behaviour and is a dominant factor in controlling global sea levels. This paper submits that remote sensing, Earth-observing satellites provide the best means of determining many of the physical parameters and properties of ice and snow relevant to climate studies, including all important geographic distribution and changes with time.

DUNBAR, Max Department of Meteorology, McGill University
805 Sherbrooke West, Montreal, Canada, H3A 2K6; (514) 398-4407

THE MARINE ENVIRONMENT AND HIGH ARCTIC DEVELOPMENT

This paper discusses the present state of climate change in the Arctic, with special reference to climatic cycles and to cycles of abundance in marine arctic fauna; the significance of these patterns to economic and industrial development in the high Arctic. The twentieth century history of climatic and economic events in Greenland (Arctic and Sub Arctic) is relevant to this topic, and is briefly covered in the paper.

FROST, Peter; EGRI, Carolyn Faculty of Commerce and Business Administration,
University of British Columbia
2053 Main Mall, Vancouver, Canada, V6T 1Y8; (604) 224-8500

SUSTAINABLE DEVELOPMENT AND CULTURAL INNOVATION

The main purpose of this presentation is to highlight the political dynamics of the innovation processes as a way of understanding why certain innovations are successful and others fail. An organizational power and politics framework for analysis highlights observable political tactics and strategies as well as the less detectable systems of influence found within the deep structure of our society. Case studies are presented. In conclusion the presentation considers the benefits, costs, and potential outcomes of alternative political strategies and tactics which can be employed to facilitate an agenda for change.

HUMPHRIES, Bob G; GEDDES, J.N; ERIKSON, P.D.; DIEHL, L.W.
MacDonald Dettwiler & Associates Ltd
13800 Commerce Parkway, Richmond, Canada, V6V 2J3; (604) 278-3411

REMOTE SENSING FOR ENVIRONMENTAL MONITORING

Whether one is interested in crop production, oil spills, climate change or the impact of a typhoon, monitoring the environment is a major challenge. Observing the environment is a multiconventional problem and it is not surprising that remote sensing is becoming a primary observation tool. This paper uses climate and weather as examples of difficult environmental monitoring challenges. The weather in particular is time critical, requires detailed observations over the whole planet, and has many different parameters that must be monitored. Coupled with this is the problem of integrating observations from diverse sources, analyzing the data and then directing the data to decision makers.

JOHNSON, Don E. Johnson Family Research and Development
256 North Fraser Drive West, Mesa, U.S.A., 85203; (602) 890-8060

STABLE PLATFORM INFRASTRUCTURES FOR OPEN OCEAN USE

Open ocean stable platform technology which combines protective breakwater systems, a captive lagoon area, and a central process island that can remain unaffected by storm-generated turbulence is discussed in this presentation. Construction and design details will be presented. Products, processes and services that are planned for the platforms will be explained.

KNASTER, Alana S. The Mediation Institute
22231 Mulholland Highway, 207A Woodland Hill, U.S.A., 91364; (818) 702-9526

HOW MEDIATION SOLVES COMPLEX PUBLIC POLICY ISSUES

Disputants in environmental\economic conflicts often find themselves continuing in a confrontation mode because there is no precedent for convening face to face talks nor a mechanism for structuring a cooperative problem solving ethic. A mediated negotiations approach provides the opportunity for opponents to exchange technical information, openly communicate their positions, and test out proposals for compromise without influencing the press or building a better case for litigation. This paper discusses such a process using case examples of mediated negotiations.

KONDO, Jiro Science Council of Japan
32-34 Roppongi, 7-Chome, Minato-Ku, Tokyo, Japan; (813) 403-6291

ECONOMIC GROWTH AND ENVIRONMENTAL PROTECTION

In the past, rapid industrialization has damaged the environment in most countries. However, for sustainable development we require technology to achieve economic growth and environmental conservation at the same time. Through the experiences in Japan, the author discusses the technology of environmental protection, the problem of developing new technology to remove carbon dioxide and other related toxics. Finally, a reformation of life style will be considered under the ancient philosophy in oriental countries.

LATHAM, Don Intermountain Forest Science Lab
P.O. Box 8089 Missoula, U.S.A.; (406) 329-4848

INFORMATION TRANSMISSION AND KNOWLEDGE-BASED SYSTEMS

Advances in computing power, the immensity of the body of information to be researched, and new developments in the field of artificial intelligence can be combined to facilitate the generation of knowledge from available information. One of the first AI techniques that is beginning to be institutionalized, is the expert\knowledge based system. Information is contained in sets of rules and knowledge is obtained by combining these rules according to simple logical procedures. The fields of agrology, silviculture, entomology, for example are especially suited to this kind of knowledge generation, because the behaviour of these kinds of system are not easily nor readily expressed in mathematical terms. The use of knowledge based systems in these fields is embryonic but will likely grow rapidly in the near term.

LEVENSON, Howard Office of Technology Assessment, United States Congress
Washington, U.S.A., 20510-8025; (202) 228-6856

ASSESSING ENVIRONMENTALLY FRIENDLY PRODUCTS

A key theme for the twenty-first century is how to design and disseminate products that are competitive in the market and less detrimental to the environment. Promoting this on a broad scale will require significant changes in how we think about the life cycles of materials and products. To date, it has not been widely applied to developing "environmentally friendly" products. Ongoing activities suggest we cannot rely solely on the free market to promote responsible development of such products. Many questions exist about the procedures and criteria needed to assess and certify products, and about the relative roles of governments, industries, consumers, and environmental groups. The exact nature of future policies is uncertain, but carefully crafted incentives should offer many opportunities to those companies that think creatively. Moreover, the clear link between sustainable development, environmental protection and developing countries should provide even greater opportunities and challenges in the future.

LOVINS, Amory Rocky Mountain Institute
1739 Snow Mass Creek Road, Old Snowmass, U.S.A., 81654-9199; (303) 927-3851

THE NEGAWATT REVOLUTION: NEW DEVELOPMENTS IN ELECTRIC EFFICIENCY

Future needs for energy can be reduced over an extremely wide range. For example, the best new technologies for efficient use of electricity - mostly less than a year old - could, if fully applied in North America today, provide unchanged or improved services with only one-fourth as much electricity as now, at an average cost of approximately ~~$ 0.8/kwh. Potential savings include 90+% in lighting, approximately 50% in industrial and building drive power, and 75 - 90+ % in space conditioning and many appliances. Yet, such savings cost less than just fuelling a thermostation, even if building it costs nothing. Even giving away such cheap saving is profitable for utilities, since their costs decline more than their revenues: they can make more money selling less electricity. But achieving such large, cheap savings requires whole-system engineering with meticulous attention to detail: not just new technologies, but also new thinking.

MAFFINI, Giulio TYDAC Technologies Inc.
310-1600 Carling Avenue, Ottawa, Canada, K1Z 8R7, (613) 722-7472

GEOGRAPHIC INFORMATION SYSTEMS: A NEW PARADIGM FOR ACHIEVING SUSTAINABLE DEVELOPMENT

Geographic Information Systems Technology has been in active use for well over two decades. The technology has now at the point where it is within the reach of end users, planners and policy makers. This paper presents a proposal on how GIS technology can be more effectively integrated into the development decision making process used by the International Development Community. The paper includes illustrations of applications on a Global and National scale.

MCDANIELS, Tim R. Western Washington University
310 - 2025 West 42 Avenue, Vancouver, Canada, V6M 2B5; (604) 263-9615

PUBLIC VALUES AND SUSTAINABLE DEVELOPMENT DECISIONS

In practice, sustainable development requires that societies confront complex decisions involving conflicting objectives and major uncertainties. This talk focuses on the normative and behavioral aspects of structuring these decision problems (i.e. asking the right questions) and representing the values of stakeholder groups regarding these decision problems (what trade-offs are appropriate). An example involving societal choices in forestry and energy production is presented.

MCFARLANE James, R. International Submarine Engineering Limited
1734 Broadway Street, Port Coquitlam, Canada, V3C 0M8; (604) 942 5223

SUBMERSIBLE TECHNOLOGIES FOR THE DEVELOPMENT OF OCEAN RESOURCES

"Knowledge of the oceans is more than a matter of curiosity, our very survival may depend upon it", so said President John F. Kennedy in the early 1960's. There has followed a truly remarkable period of technological development in the oceans. Most of the effort, however, has been extended in the development of equipment for use in support of operations in the off-shore petroleum industry. This paper reviews some of the developments to date, and speculates on directions of future developments in submersible technologies for the development of ocean resources.

NORTH, Wheeler J. California Institute of Technology
Kerckhoff Marine Laboratory; 101 Dahlia Avenue, Carona Del Mar, U.S.A., 92625; (714) 673-9894

BIOLOGICAL OPPORTUNITIES ASSOCIATED WITH LARGE OFFSHORE PLATFORMS

Biological opportunities associated with large offshore platforms include a naturally occurring phenomenon (harvesting of organisms developing on or attracted to the structures), and an artificial activity (aquaculture). This paper discusses primarily the artificial phenomenon. Most surface waters in the temperate and tropical seas are severely nutrient limited. Consequently, any aquaculture must be supported by fertilizing. A convenient source of nutrients is deep ocean water that can be artificially upwelled. Potential products are food and biomax. A marine farm might also be used to sequester CO_2 from the atmosphere. Constraints imposed by the various products and\or usages of a marine farm are discussed.

POUNDER, David Department of the Environment, United Kingdom Government
Room B, 357 Romney House, 43 Marsham Street, London, England SW1P 37Y; (44) 1-276-8310

CLEANER PRODUCTION: SETTING THE TARGETS FOR NEW DESIGN

The biggest single challenge for chemical engineers in the 1990's will be to develop a theoretical and then a practical methodology for waste minimization. Case studies can be used to illustrate the concept and the EPA Waste Minimization Opportunity Assessment Manual describes systematic procedures for identifying waste minimization opportunities. Using examples, this presentation suggests that there is scope for a breakthrough in methodology which is analogous to the target setting for industrial energy consumption that led to a more systematic design of heat exchange in networks. This analysis also reveals technical challenges which need to be solved and gives related targets for research. Finally, the presentation contrasts the traditional process design approach with a new approach that answers the demands of today's society.

RIDDLE, Martyn J. International Finance Corporation
Room 1 10-151 1818 H Street North West, Washington, U.S.A., 20433; (202) 473-0661

THE ROLE OF THE INTERNATIONAL FINANCE CORPORATION IN MARKETING NEW ENVIRONMENTAL TECHNOLOGIES IN DEVELOPING COUNTRIES

A number of developing countries have rapidly expanding industrial bases and there is a consequent need for provision of environmentally oriented goods and services, particularly in regions of high population and industrial concentration. The International Finance Corporation (IFC), an affiliate of the World Bank, believes that this demand for environmental goods and services could lead to business opportunities in which IFC could invest. Examples of possible projects include:

1) collection, treatment and disposal of hazardous and toxic wastes;
2) treatment and disposal of industrial municipal waste waters;
3) treatment and supply of portable water;
4) manufacturer pollution control equipment and monitoring instrumentation;
5) provision of consultant, engineering and laboratory services.

This presentation reviews the investment opportunity in companies providing environmental goods and services in developing countries.

RUSTEN, Bjorn; PAULSRUD, Bjarne Aquateam - Norwegian Water Technology Centre
P.O. Box 6326, Etterstad, 0604 Oslo 6, Norway; (47) 2-67-9310

TREATMENT OF WASTEWATER IN POLAR ENVIRONMENTS - STATUS AND FUTURE TRENDS IN SCANDINAVIA

This presentation deals with treatment of waste water in low temperature regions of Scandinavia with emphasis on treatment of waste water from small communities and recreation areas. The basic principles of chemical and biological treatment plants described in case studies of different types of waste water treatment plants are presented, including treatment results and the special prerequisites of low temperature design. Finally, the future trend of using either a large, low loaded, outdoor treatment plant or a compact, high loaded, indoor treatment plant is discussed. Several compact, prefabricated systems currently under development are presented.

SHRIVASTAVA, Paul Bucknell University
Lewisberg, U.S.A., 17837; (717) 524-1821

HUMAN, ORGANIZATIONAL AND TECHNOLOGICAL CAUSES OF ENVIRONMENTAL CRISIS

Environmental crisis originating from industrial accidents such as the Exxon Valdez Oil Spill or the Bhopal disaster have very complex causes. Preventing such crises requires understanding these causes and dealing with them. This presentation describes a framework for understanding causes of environmental crises that includes human, organizational, and technological failures. Managerial strategies for preventing such crises are discussed.

SMITH, Stuart L. RockCliffe Research and Technology Inc
1105 - 350 Sparks Street, Ottawa, Canada, K1R 7S8; (613) 232-7772

STRATEGIES FOR DEVELOPING MARKETABLE ENVIRONMENTAL TECHNOLOGIES

In the industrialized world, many environmentally beneficial technologies can be sold only when the market is deliberately influenced by social and environmental factors expressed in the form of regulation, effluent charges, or consumer action. In the developing world, neither markets nor regulations exist to encourage the development of technology appropriate to the problems faced in those areas. This paper suggests that an international cooperative effort is needed to support the development and subsidize a deployment of environmentally friendly technology in countries that are starting to industrialize.

THOMPSON, Dickson Faculty of Environmental Design, University of Calgary
2500 University Drive North West, Calgary, Canada, T2N 1N4; (403) 220-3625

DESIGNING AND ASSESSING PRODUCTS FOR THE 21ST CENTURY

Product and Technology Assessment (PATA) is an attempt to predict impacts of products and technologies on a life cycle basis. It includes socio-economic, health and safety, and biophysical environment safety considerations. Since the early 70's the technology assessment activities in Canada have increased dramatically. A very general model of a PATA process is presented in this paper with particular emphasis on a general materials balance. Input/output model (raw materials extraction and processing, manufacturing, marketing, use, disposal).

WOOLSEY, J. Robert; CRUICKSHANK, Michael J. The Marine Minerals Technology Centre, Continental Shelf Division, University of Mississippi,
202 Old Chemistry Building, U.S.A., 38677; (601) 232-7320

MARINE MINING TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT

While increasing populations and other factors are increasing demands for mined materials, environmental demands are acting as a constraint on the development of new mineral resources on land. The development of material resources from the marine environment is indicated in this presentation to be an alternative solution which would be both economically and ecologically sustainable for the foreseeable future. This presentation details some of the benefits and some of the costs of mining the sea beds.

ZIMMERMAN, Janos J. Organization of Eastern Caribbean States
Box 1383, McVane Drive, San Souci, Castries, San Lucia, West Indies; (809) 452-1837

COMPUTER BASED TOOLS FOR SUSTAINABLE DEVELOPMENT PLANNING

The work described in this paper relates directly to the issue of merging environmental and economic decision making. The paper describes the generation of a simulation model, which merges economic, environmental and physical planning decision making. The model is considered an educational tool to assist professionals in decision making concerning overall development planning. It was developed by the GTZ (German Agency for Technical Cooperation Limited) for the Natural Resources Management Unit of the Organization of Eastern Caribbean States (OECS). This model is only a beginning. Further development, practical application and more careful documentation and discussion on the model inter-relationships will be required.

STREAM C1 AND C2

SETTING THE STAGE:
SUSTAINABLE DEVELOPMENT AND THE URBAN FUTURE

ATKINSON, Sallyanne Lord Mayor, City of Brisbane
Box 154 Brisbane Australia 4001; (07) 225-4058

RECIPE FOR URBAN SUSTAINABILITY

The direction of our world will be determined in our cities, with their concentrations of people and economic activity. The challenge confronting city governments is to provide a sustainable environment for the populous - a balance of necessary urban infrastructure to allow a quality at home, or outdoors. Brisbane is meeting the challenge of a community to lead and provide answers by planning for the future, with an emphasis on: developing reliable information systems and data bases of our resources, both natural and man-made; consulting the city's residents; advocating attitudes which promote the need for awareness of the environment; implementing the required bureaucratic and environmental changes; developing strategic plans for the city.

JACOBSON, Jodi World Watch Institute
1776 Massachusetts Avenue North West, Washington D.C., U.S.A., 20036; (202) 452-1999

THE FUTURE OF URBANIZATION: FACING THE ECONOMIC AND ECOLOGICAL CONSTRAINTS

Aside from the growth of the world's population, urbanization is the dominant demographic trend of the late 20th century. However, the rapid economic growth and abundant resources that contributed to the rise of large cities throughout the world can no longer be taken for granted. Urban areas, larger and more numerous than ever, have outgrown the capacity of natural and social systems to support them. As a result, todays cities may be inhibiting, rather than aiding, efforts to raise living standards in an equitable fashion. A more sustainable pattern of urban development - springing from reliance on renewable energy resources, efficient transportation systems, recycling of materials and nutrients, and a better rural - urban balance - is needed for the future.

MAYBERRY, John Dofasco Steel
P.O. Box 2460, Hamilton, Canada; (416) 544-3761

SETTING THE STAGE: SUSTAINABLE DEVELOPMENT IN THE URBAN FUTURE

Dofasco Steel is Canada's largest integrated steel plant. Dofasco has operated for more than 75 years in the central core of the city of Hamilton, on the western end of Lake Ontario. The company and the community have worked together to dramatically improve their quality of life and the environment over the last 20 years. For example, Dofasco, at a cost of over $400,000,000. has reduced air and water emissions by 95% while production levels have doubled. At the same time, resources for commerce, education, medicine, the arts and recreation have expanded dramatically. Both Dofasco and the Region recognize that we ultimately live in a global community. We must set an example by developing and implementing world-class plans if we are to achieve an environmentally and economically sound future.

OKALI, A.U. United Nations Centre for Human Settlements (HABITAT)
2 U.N. Plaza Room, DC2 - 0943 New York, U.S.A., 10017; (212) 963-4200

SUSTAINABLE DEVELOPMENT AND THE URBAN FUTURE

The basic thrust of this presentation is to show the critical importance of urbanization, particularly in the developing countries, for any meaningful concept of sustainable development. Urbanization, which in many ways is the most significant phenomenon shaping the future of developing countries, will be shown to be not only inevitable and irreversible but also necessary to the development prospect. For these reasons, it will be argued, it is well worth extending the effort and the resources to assist the developing countries to manage the urbanization process and thereby to achieve functionally productive and liveable urban environment.

STREAM C1

STRATEGIES FOR SUSTAINABLE URBAN UTILITIES

CHAPLEAU, Robert Transportation Department/Department of Civil Engineering,
Ecole Polytechnique de Montreal
P.O. Box 6079, Station A, Montreal, Canada, H3C 3A7; (514) 340-4809

RECENT TRENDS IN URBAN TRANSPORTATION DEMAND AND THEIR POTENTIAL IMPACTS

New challenges for transportation planners have emereged from recent trends observed in many of the large urban areas of developed countries. In particular, demographic trends, combined with changes of societal values are generating a steady decline of transit usage, higher highway congestion and numerous related transit financing and environmental problems. The Canadian experience reflects extensive efforts undertaken recently to address these questions with the aid of newly available information system technology. Issues addressed using this information system technology include impacts of demographics on urban sprawl on future transit usage, forecasting of short-term trends in urban traffic congestion, estimation of "spill-over effects" and Model's split forecasting and market analysis of specific clientele.

CHOATE, Kim D. Water Quality Department, Tennessee Valley Authority
H.B. 2S 270C, 311 East Broad Street, Chattanooga, U.S.A., 37402; (615) 751-7314

WASTEWATER TREATMENT BY CONSTRUCTED WETLANDS

The Tennesee Valley Authority (TVA) believes that wetlands can be designed, engineered and constructed for beneficial uses. A constructive wetlands technology is an innovative "natural" treatment process which is effective, simple to operate, and affordable. It potentially can solve many non point source pollution problems and waste water treatment in small communities, rural areas, institutions and businesses which are causing environmental, public health and economic development problems. However this "natural" technology is relatively unknown to potential users, consulting engineers, and regulatory agencies. This presention demonstrates the use of constructive wetlands by the TVA and identifies eight major objectives. Initial data from a three year monitoring program for the municipal system, successes, problems in design guidelines for various applications of constructive wetlands are presented.

FUREDY, Cristine Faculty of Environmental Studies, York University
4700 Keele Street, North York, Canada, M3J 1P5; (416) 736-5252

MODERNIZATION AND WASTE ABSORBING CITIES IN ASIA

Traditional Asian cities were able to absorb most of their wastes in farms and ponds. Now modernization is reducing waste absorption and the large cities are experiencing disposal crisis. Involving locally appropriate waste management, both city planning and foreign advisers should consider the traditional strength of Asian waste treatment together with waste reduction and well designed land fills. Illustrations are drawn from Beijing, Calcutta, Guangzhou, Jakarta, Manilla, and Shanghai.

KERR, Shelagh D. Grocery Products Manufacturers of Canada
101 - 1185 Eglinton Ave., Don Mills, Canada, M3C 3C6; (416) 429-4444

PACKING OPTIONS

Packaging currently being disposed of in land fill sites is a major concern in the discussion of solid waste management. This presentation focuses on the options of reduction, recycling, reuse and recovery of packaging materials to contribute to an overall fifty percent reduction in waste to land fills by the year 2000. Both consumer packaging and industrial packaging issues are addressed.

KRUGEL, Linda Portland Energy Office
1120 Southwest 5th, Room 1030, Portland, U.S.A., 97204; (503) 796-7222

PLANNING FOR A SUSTAINABLE ENERGY FUTURE

The Sustainable Cities project is funded by the U.S. Department of Energy, and managed by the Energy Task Force of the Urban Consortium. A national advisory committee of local, state, federal, and utility officials that assists the cities. Lawrence Berkeley Laboratory is providing technological assistance for the project. This paper presents insights into sustainability and practical planning methods appropriate for local governments and under the auspices of the sustainable cities project. Each city is using its strategic planning process to reduce future energy use while maintaining the cities livability, diversity, economic strength and environmental quality. The process provides a framework for identifying policy and program options.

LAMBA, Davinder Mazingira Institute
P.O. Box 14550, Nairobi, Kenya; (254) 2-47066

THE URBAN COOKING FUEL SITUATION IN A THIRD WORLD COUNTRY (KENYA)

The urban household in Kenya generally use a mix of fuels, the better off using electricity for lighting, kerosene and/or charcoal for cooking, the less well off using kerosene for lighting and charcoal and/or firewood for cooking. The urban low income groups paid proportionally more of their incomes on domestic energy than those who are better off. Greater hardships are created by rising urban wood fuel prices. The diet of the urban poor is becoming less balanced due to a lack of affordable cooking fuel. This has adverse implications on their nutritional status.

LEVENSON, Howard Office of Technology Assessment, United States Congress
Washington D.C., U.S.A., 20510-8025; (202) 228-6856

"IS IT REALLY POSSIBLE TO REDUCE MUNICIPAL SOLID WASTE GENERATION?"

Managing municipal solid wastes (MSW) is a critical problem for communities everywhere. In response, many national and local governments are trying to increase recycling. The most fundamental question is whether we can reduce the toxicity of MSW generated in the first place. There are two routes to MSW reduction. Manufacturers can modify the design of products or they can contain fewer toxic substances or generate less waste when discarded. Consumers can modify purchasing decisions by buying products that are less toxic, more durable, or reparable; unfortunately, the economic incentives and information necessary to stimulate these changes are generally lacking, unlike the situation with hazardous wastes. This paper discusses governmental policies that could help move us towards a waste free city.

LIVINGSTON, Allen P. Associated Engineering (Ontario) Ltd.
#525 - 21 Four Seasons Place, Etobicoke, Canada, M9B 6J8; (416) 622-9502

EMERGING TRENDS IN WATER QUALITY STANDARDS: IMPACT ON WATER TREATMENT PROCESSES

Comprehensive reviews of water quality standards and guidelines are underway in Canada, the U.S. and the European Community. Emerging from these reviews will be increasingly stringent requirements to limit human exposure to the contaminants in drinking water. The paper identifies several of the most significant trends developing with regulatory authority such as Health and Welfare Canada, USERA, World Health Organization and the European Community, and speculates on the future requirements for water treatment that might emerge. Particular attention is paid to additional limits for organic compounds and disinfectant by-products.

LIZT, Sonia Secretaria General de Obras
Pitagoras 208 3rd floor, Mexico City, DF, Mexico, 03100; (6) 88-74-29

TRANSPORTATION PLANNING IN A MEGALOPOLIS

Mexico has 83 million inhabitants of which 53% live in urban areas. The metropolitan zone of Mexico city is considered to be the largest in the world. It houses 19.8 million people, the equivalent of 25% of the entire national population. High levels of environmental pollution are caused by automotive vehicles, noxious industries and home heating. This presentation discusses the problems of transportation planning in the city which is undergoing extreme urban growth.

MANLEY, Paul; GIES, G.M; BAILLIE, R.L; NIELSEN, R.O; JANES, N.K.
Airite Environmental Industries Inc.
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OPERATING A PILOT PROJECT FOR HIGH RATE IN-VESSEL COMPOSTING OF MUNICIPAL SOLID WASTES

As waste reduction and diversion gain momentum and support, removal of the organic fraction of municipal solid wastes (MSW) is receiving renewed attention. Primary effort is currently being directed at processing leaves and other yard wastes utilizing low technology time consuming windrow methods. The historical problems of contamination by heavy metals and inert materials such as glass and plastics must be resolved in order to establish municipal solid waste compost that is acceptable and safe for wide spread use. Adequate markets and applications must be established for the large volumes of compost which will be available. This presentation uses a pilot scale program in Powell River, British Columbia. Information from an extensive lab analysis and marketing testing program is included.

MCGARRY, Michael Cowater International
304 - 411 Roosevelt Ave., Ottawa, Canada, K2A 3X9; (613) 722-6434

URBAN WATER SUPPLY: THE DEVELOPING COUNTRY CHALLENGE

This paper presents the coverage and demands for urban water supply in developing countries as we move out of the International Drinking Water Supply and Sanitation Decade and into the 90's. Demands due to rapid increases in population are highlighted as are the extreme difficulties of government working in the lowest income areas of the city. The need for novel appropriate technology and service levels are covered as are the need for improved implementation strategy and institutional arrangements.

OGASAWARA, Hidenbou Foreign Affairs, Clean Japan Centre
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JAPANESE APPROACH TOWARDS WASTE MINIMIZATION AND ITS FUTURE PERSPECTIVES

The involvement of Clean Japan Centre with waste management and recycling acitivities traces back to 1975. As with all industrial countries Japan is facing serious waste management problems. There is a difficulty in securing disposal sites, and waste minimization and reduction, which includes recycling, is being placed as a top priority amongst waste management alternatives. Local communities practice sort separation and group collection programs in order to reduce the volume of household waste before collection for treatment and final disposal. This presentation discusses Japan's approach to waste minimization.

PARKINSON, Tom Transport Consulting Ltd
1141 West 7th Avenue, Vancouver, Canada, V6H 1B5; (604) 733-5430

ENERGY EFFICIENCIES OF URBAN TRANSPORTATION

The energy efficiencies of various private and public urban transport modes are compared in this presentation. Means to reduce energy use are discussed, ranging from possible changes in land to methods that use and density that will permit employees to live close to work - (favouring walking and cycling commutes) - to methods that encourage a switch from the automobile to public transit. Future trends are examined including more energy efficient, lower pollution, cars and buses, use of electricity and alternate fuels, road pricing or licensing and the substitution of telecommunications for transportation.

SOBERMAN, Richard Department of Civil Engineering, University of Toronto
35 St. Georgia Street, Room 107, Toronto, Canada, M5S 1A4; (416) 978-3096

ENVIRONMENTALLY-FRIENDLY TRANSPORTATION - OVERVIEW

Reducing the number of vehicle - kms of travel is the key to environmental friendliness in urban transportation. For any given level of urban development, the number of vehicle - kms depends upon a number of factors, the most important of which are the spatial structure of related land uses, density of the development, and various transportation policies that influence the intensity with which the different modes of transportation are used. This paper is concerned with barriers to better integration of transportation and land use planning that could reduce transportation needs, as well as barriers to developing urban transportation systems that are more efficient from a standpoint of costs, land requirements, and energy.

STEPHENSON, Derek Resource Integration Systems Ltd.
#2-400 Mount Pleasant Road, Toronto, Canada, M4S 2L6; (416) 480-2420

THE BLUE BOX SYSTEM

Cities throughout north America have established ambitious waste reduction targets that typically range from 25-50%. To date, reduction efforts have focused largely on curb-side or "blue box" recycling. Some 11,000,000 north American households now have curb-side recycling service, and this number is expected to double by 1991. As curb-side programs expand, important questions remain: how much waste can ultimately be diverted through curb-side recycling? How can curb-side recycling be used as an opening for more aggressive waste reduction? How can it be fully integrated into broader waste management strategies? This presentation examines these and other questions in order to assess the contribution of curb-side recycling to the "waste-free city".

TAMBLYN, Robert Engineering Interface Ltd
2 Sheppard Avenue East, Suite 200, North York, Canada, M2N 5Y7; (416) 226-6565

THE THREE R'S OF ENERGY MANAGEMENT IN BUILDINGS

This paper reviews the potential for energy conservation in urban buildings. The energy used for buildings in Ontario is divided into end use and conservation. The energy management process; redesign, retrofit and recommissioning are discussed. Barriers to energy conservation are reviewed in the context of the case study. Energy management potential for new building design is also presented.

WELLER, Phillip E. Great Lakes United
216 Cassety Hall, State University College, 1300 Elmwood, Buffalo, U.S.A., 14222; (716) 886-0142

PROVISION OF CLEAN WATER - A NON-GOVERNMENT INTEREST GROUP PERSPECTIVE

The Great Lakes - Saint Lawrence River ecosystem is the largest freshwater system in the world, containing twenty percent of the world's surface fresh water. Despite, or maybe because of their immensity, the Great Lakes have become contaminated by a variety of human wastes. Great Lakes United is a coalition of organizations from throughout the Great Lakes area concerned about human and ecological health in the region. The organization is dedicated to eliminating toxic and other contaminants from the Great Lakes. The unique bi-national programs and activities of the organization to achieve this goal are discussed in this presentation.

WELCH, Robert S. International Joint Commission
100 Metcalfe Street, 18th Floor, Ottawa, Canada, K1P 5M1; (613) 995-2984

THE GREAT LAKES: AN INTER-GOVERNMENTAL PERSPECTIVE

The Great Lakes, one of the largest bodies of fresh water in the world, are immeasurably important in ecological, economic and social terms. They provide fisheries and wildlife habitat, transportation, power and processing waters, recreational opportunities and drinking water for several million people. While vast, they are not inexhaustible. We have learned that they can be seriously depleted and damaged by the same human activities that rely on their continued integrity. Part of the challenge in protecting the Great Lakes is ensuring sustained coordination and commitment of many jurisdictions involved. The 1972 Great Lake's Water Quality Agreement, twice amended, provides a framework for action. The International Joint Commission has a role in assessing, and to a limited degree, coordinating progress in agreement programs.

STREAM C2
SUSTAINABLE URBAN AREAS

BENJAMIN, Stan PLAN:NET - Development Planning and Management Network
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ENVIRONMENT AND THE URBAN POOR: A NECESSARY BUT UNHOLY ALLIANCE - THE CASE OF EARCHQUAKE RESISTANT LOW INCOME HOUSING FOR SAN SALVADOR

Two themes will be explored in the presentation. First, the "cycle of degradation" will be looked at in the relationship between the poor and environment in most third world cities. In this cycle, frequently the only areas of the urban environment available to the poor are marginal, ecologically sensitive, and even dangerous. By settling these marginal areas, the poor create or exacerbate environmental problems. The cycle is completed when the degrading impacts of these settlements imperils the health and safety of their inhabitants: and their "better off" neighbours. The second theme explored, is the situation of San Salvador, El Salvador, and the components of an experimental housing project designed to prevent this degrading relationship between the poor and the urban environment.

BRENKE, Siegfried Urban Affairs, Organization for Economic Cooperation and Development
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QUALITY OF LIFE IN THE DEVELOPED WORLD

If we are to achieve qualitative economic growth in the developed world, the notion "quality" first needs to be agreed upon. Such an argument is also essential in defining instruments to measure success and failure of urban policy. However, what might be called an "urban objective function" may never be available. This presentation compares several ways by which the notice of "quality of urban life" may be approached in practical terms. In particular, a concept or an "urban observatory" will be described incorporating elements such as set of urban indicators, examples of "good urban practice" and ways to improve continuous exchange of decentrally collected information.

DE KLERK, Len Department of Housing and Development
Galvanistraat 15, P.O. Box 6623, Rotterdam, The Netherlands 3002 AP; (31) 10-489-5569

ROTTERDAM: URBAN REVITALIZATION AND QUALITY OF LIFE

Since the early seventies, urban development and the quality of life have been integrated policy issues in the city of Rotterdam. The post-war rebuilding period (1945-1970) was characterized by rebuilding a new city centre; developing the largest port in the world and developing one of the largest petro-chemical industrial complexes. The second period (1970-1985) was characterized by a policy change towards the quality of urban life, in particular by setting up an urban renewal policy in the pre-war districts. The third phase of urban policy (post-1985) can be characterized as comprehensive revitalization of the environment. Urban revitalization means to create better conditions for living, entertainment, recreation, business, public transport, communications. This presentation describes the changing conditions and the changing efforts to achieving a balanced community.

EGGLETON, Art City of Toronto
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TORONTO HEALTHY CITY PROJECT

Cities have a major role to play in fostering sustainable development. What is required are bold initiatives by municipal council and changes in the way decisions and policies are made. This presentation describes how Toronto has begun to ensure that it is livable into the next century. As part of its goal to achieve a Healthy City, several actions are under way to address environmental and social issues. These include: an environmental protection office, a comprehensive review of the official plan, an examination of transport options and ways to reduce carbon monoxide emissions, actions to preserve public safety and prevent violence, a Food Policy Council and more. A Healthy City Office has been established to facilitate, monitor and initiate projects which will move the city towards the preferred future and a higher quality of life for its citizens.

GELLER, Michael The Geller Group
207, 601 West Cordova Street, Vancouver, Canada V6B 1G1; (604) 687-3204

ENVIRONMENTAL ISSUES IN VANCOUVER AREA DEVELOPMENT PROJECTS

Urban development is often seen to be in conflict with environmental concerns. However, in many respects, good development can contribute to and enhance the environment. Redevelopment of derelict industrial sites can often result in environmental cleanup; well planned projects can often enhance the natural environment; and well-located projects can decrease reliance upon the automobile, a major source of pollution. Vancouver has been the setting for a number of significant redevelopment projects which serve as examples of how to better urban space. This presentation describes four Vancouver area projects and demonstrates how better urban space can be planned within the framework of environmental concerns.

GREENHALGH, Paul Andersen Consulting, Arthur Anderson and Co.
141 Arthur Street, North Sydney, Australia 2060; (61) 2-964-6000

MULTI-FUNCTION POLIS: AN INTERNATIONAL JOINT VENTURE TO CREATE A CITY OF THE FUTURE

This paper reports on the outcomes of a major consultancy undertaking by Anderson Consulting at the behest of the Australian and Japanese governments. The consultancy's major objective has been to take an exciting but only partially developed idea and evolve this towards feasibility. The idea: two countries - Australia and Japan - acting jointly and purposively to create a city of the future. This special place, a Multi-function Polis, was conceived to both demonstrate possible future urban forms and lifestyles and to foster a commercial and institutional framework supportive of the emerging growth industries of the 21st century.

HALL, Peter Institute of Urban and Regional Development, University of California, Berkley
316 Wurster Hall, Berkley, USA 94720; (415) 624-6579

PLANNING BETTER URBAN SPACE: A PLANNER'S PERSPECTIVE

Better urban space looks good, feels good and works well. To combine the three is the problem of the designer-planner. Space that looks good in photographs may not feel good to walk through, drive through, live or work in; space that has these qualities may not look conventionally good. Further, an urban environment that looks and feels right may work badly, and vice-versa. Today, mindful of past disasters, we seek urban environments at a human scale: will they work? This presentation asks whether planning can square this circle.

KIERNAN, Matthew Peat Marwick, Stevenson and Kellogg
386 Broadway Avenue, Suite 604, Winnipeg, Canada R3C 3N6; (204) 944-1014

INNOVATIVE HOUSING PARTNERSHIPS AND SUSTAINABLE DEVELOPMENT

The Winnipeg Core Area Initiative is a tri-governmental urban partnership which, over its five year term, used its $96 million budget to generate nearly three-quarters of a billion dollars worth of public and private sector investment in the physical, economic, and social revitalization of Winnipeg's downtown and the ten square mile inner city. The breadth and scope of the C.A.I's activities is without precedent in North America or Europe: over a thousand projects have been implemented, in policy areas including housing, neighbourhood revitalizations, health, education, social services, employment and training, small business, industrial development, heritage preservation, and joint venture commercial development. This presentation discusses the C.A.I. as a case illustration of sustainable development, and will stress the integration of shelter and shelter-related issues within the broader urban community, organizational, and political context.

MASKREY, Andrew Intermediate Technical Development Group
Casillam 18 - 0620 Lima, Peru 18; (51) 14-221-361

PLANNING BETTER URBAN SPACE: LESSONS FROM VILLA EL SALVADOR

Housing for people and housing by people are two common but mutually opposed approaches towards the production of urban space. This paper looks at the results and implications of both approaches in the context of Lima, Peru. On the basis of a case study of Villa El Salvador, a peri-urban low-income settlement of 300,000 people, it argues that participation of both community-based urbanization and government is essential in order to bring about substantial quantitative and qualitative improvements in the built and social environment and that the roles of both actors are complementary.

STREAM C2: SUSTAINABLE URBAN AREAS

ORR, Wilson Tucson Solar Village
City Manager's Office, Box 27210, Tucson, U.S.A., 85726-7210

TUCSON SOLAR VILLAGE: OPEN PLANNING

Shelter and sustainability are linked by environmental, economic, and social factors. Sustainable shelter (housing) design should occur within the context of a sustainable community plan to link housing with these related factors. This planning process may be smoothed by including predesigned public input; we call the entire thing "open planning". Shelter design then evolves from a complete community concept with environmental, economic, and social goals. Federal, state, and local governments have an exciting opportunity to cooperate financially and functionally to open this planning process both to public input and Mega-issues of Sustainability.

SETAMANIT, Surin Faculty of Engineering, Institute of Environmental Research,
Chulalongkorn University
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ENVIRONMENTAL PLANNING AND AUDITING: LESSONS FROM THAILAND

Environmental impact assessment as an official planning and decision making tool for Thailand is described, emphasizing the difficulties experienced as a result of modelling its approach after a developed country with different social and economic backgrounds. Three case studies are examined with respect to the methodologies employed to reveal how an E.I.A. could be streamlined, monitoring programs made more selective, and an environmental development plan developed to bring about a smooth approach to decision making.

SMITH, Ann C. Corporate Health, Safety and Environmental Sciences, Allied-Signal Inc.
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ENVIRONMENTAL DESIGN REVIEW OF AN ADVANCED TECHNOLOGY LABORATORY: PRINCIPLES AND PRACTICE

This paper describes a detailed Health, Safety, and Environmental (H.S.E.) design review which was undertaken to assure minimal impact from an advanced technology laboratory at Allied-Signal's Morristownship (New Jersey) World Headquarters Site. The review was consistent with the standard H.S.E. "auditing" program carried out at Allied-Signal's operating locations. Underlying H.S.E. management principles are discussed, and conclusions from the specific case are presented.

WENE, Clas-Otto Department of Energy Conversion, Chalmers University of Technology
Goteborg, Sweden S-412; (46) 31-72-1445

INTEGRATED ENERGY AND ENVIRONMENTAL PLANNING AT THE MUNICIPAL LEVEL

The methodology developed at Energy Systems Technology (E.S.T.) makes it possible to study cost-effective solutions to the combined problems of developing energy systems and controlling emissions from the system. The methodology is built around a model for the energy system, MARKAL, which has been developed as a cooperative project within the framework of the International Energy Agency. MARKAL has been adapted to the municipal level by E.S.T., and the implementation is made in close cooperation with the municipal authorities. This presentation deals with the case studies of five Swedish communities.

WHITE, Elizabeth Advanced House
Marsh Hall Farm, R.R.#4, Stirling, Canada K0K 3E0; (613) 395-5392

THE ADVANCED HOUSE: A SMALL STEP TOWARDS ENVIRONMENTALLY RESPONSIBLE HOUSING FOR CANADA

Canadian housing, although it is more energy efficient than it was twenty years ago, still uses far more energy than the planet can afford. Society has to find ways to make housing truly sustainable in a global sense. The Advanced House project is a small step towards environmentally-responsible housing. It demonstrates that new products and technology, much of it developed in Canada, can significantly reduce total home energy use without compromising comfort and safety. The Advanced House is predicted to use a total of 11,669 kiloWatt hours per year for all purchased energy use. This is less than one-third of the energy used in an equivalent conventional home built to Ontario building code standards, and about half the energy used in an equivalent R2000 home. This paper describes the technical components of the house, the predicted performance, and the latest testing and monitoring data.

STREAM D1
INTERNATIONAL PERSPECTIVES: GLOBAL ISSUES

BEATON, J.D; KENG, J.C.W. Potash and Phosphate Institute of Canada
Suite 704, C.N. Tower, Midtown Plaza, Saskatoon, Canada, S7K 1J5; (306) 652-3535

POTASSIUM: A VITAL INPUT IN SUSTAINABLE AGRICULTURE

Global agriculture must satisfy the increasing demand of an expanding population for food, fibre and other commodities. Traditional agriculture systems are no longer adequate to meet these requirements. Modern crop development based on intensive inputs including proper soil fertility management are now vital. It must be recognized that such systems are not sustainable if plant nutrients removed by cropping are not replenished in appropriate amounts. Government policy makers and planners must be responsible for insuring food security by providing the technical means to increase agricultural productivity in a sustainable manner.

BENTLEY, Fred University of Alberta
13103 - 66 Avenue, Edmonton, Canada, T6H 1Y6; (403) 435-6523

OPPORTUNITIES IN MAINTENANCE AND ENHANCEMENT OF LAND PRODUCTIVITY

The seriousness of global degradation of agricultural lands under use is inadequately known. Annually, large areas become impaired beyond hope of reclamation. On much larger areas, yield declines are so serious as to endanger sustainability by present methods of agricultural production. Soil degradation is endangering survival of civilization. This presentation deals with the nature and causes of the degradation of farmland and follows with proposals that have realistic potential to reduce much of the degradation, especially in tropical regions. Consideration is also given to the degradation of farmlands in Canada.

BRUNEAU, Angus Newfoundland Light and Power Company Limited
P.O. Box 8910, 85 Kenmount Road, St. John's, Canada, A1B 3P6; (709) 737-5616

IMPLEMENTATION - THE ROLE OF TECHNOLOGY AND PUBLIC PERCEPTIONS

Uncertainty and inadequate and misleading information often give rise to public fears which are at odds with objective measures of risk, but are powerful determinants in public policy formation and a (mis) allocation of resources. This paper explores some of the factors that influence the public's perceptions of and responses to risk to people and to the natural environment. It comments on the responsibility of those whose activities are perceived to contribute to public and environmental risks with a focus on energy conversion processes and technologies.

CLINE-COLE, Reginald International African Institute, Bayero University
P.M.B. 3011, Kano, Nigeria; (64) 601-280

THE NON-GOVERNMENTAL ORGANIZATION (NGO) IN FAMINE PREVENTION, RELIEF AND REHABILITATION: ETHIOPIA'S CHRISTIAN RELIEF AND DEVELOPMENT ASSOCIATION (CRDA) IN THE 1980'S

Famine is endemic in the country of Ethiopia. Here, famine is an insidious process which can be predicted, prevented and/or managed, and its worst consequences minimized. This paper reviews one set of strategies for famine prevention, relief and rehabilitation during the 1980's: that employed by the CRDA, the NGO umbrella organization in the country. This role is examined both within the specific context of food security, and as part of wider concerns addressing issues of sustainable development.

DE LARDEREL, Jaqueline Aloisi United Nations Environment Program
Tour Mirabeau, 39 - 43 Quai Andre Citroen, Paris, France, 75739-15; (33) 1-40-588858

CLEANER PRODUCTION: A CHALLENGE TO INDUSTRY AND TRADE

In the dawning era of sustainable development, industry is being challenged to "produce more with less" and to "pollute less while producing more". Cleaner production through cleaner processes and cleaner products is one of the key responses to this challenge. This is a call, not just to treat manufacturing pollution, but to prevent it. In order to lessen their adverse impact on the environment, products must integrate environmental considerations throughout their life cycle: from extraction of the necessary raw materials, to manufacture, to use, to disposal.

EELKMAN ROODA, Franz E. McKinsey and Company
Amstel 344, 1017 AS, Amsterdam, The Netherlands; (31) 20-55-13777

FUNDING MECHANISMS TO PROTECT THE GLOBAL ATMOSPHERE

Global atmospheric change presents the world with an environmental threat of unprecedented complexity in terms of sources, implications, and possible solutions. However, a meaningful response is not beyond mankind's technical and economic reach, provided genuine international cooperation can be achieved. A wide range of feasible options to reduce releases of trace gases into the atmosphere exists on a world-wide scale. The challenge lies in building, expanding and funding the mechanisms to productively utilize this global potential. One such mechanism is an international clearing house, enabling agreement on changes to improve the environment between countries. This presentation deals with the make-up of such a clearing house and how it will facilitate the maximizing of the global environmental yield with limited financial resources.

GIBBS, Graham Safety, Health, Environment International Consultants' Corporation
Box 27, Site 17, RR # 2, Winterburn, Canada, TOE 2NO; (403) 987-2883

HEALTH ENVIRONMENT AND TRADE IN THE 90'S

In the 1990's industry and government will face increasing public pressure to demonstrate leadership in protecting the health of workers, communities and environment in the developing world. Solutions to global environmental problems increasingly involve both developed and developing countries. Bans or talk of bans may have serious economic impacts on developing nations. Conversely, the environmental abuse of an agent in a developing country may both annihilate an industry and perhaps deprive the world of an invaluable product. The impact on trade can be significant. An international, multi-stakeholder initiative is proposed to help businesses and developing nations meet these 1990 demands.

LOVINS, Amory Rocky Mountain Institute
1739 Snowmass Creek Road, Old Snowmass, USA, 81654-9199; (303) 927-3851

ABATING GLOBAL WARMING FOR FUN AND PROFIT

New technologies for efficient use and renewable supply now make it cheaper to save most of the fuel we use than to buy and burn it. Thus reducing pollution by not burning fuel doesn't cost money and jobs: it creates wealth and jobs; and, being profitable, it can be done largely through the market rather than by regulatory mandate. For example, Sweden is far more energy efficient than Canada and has a similar primary resource and industrial structure. The Swedish Power Board found, with 54% economic growth and a complete phase-out of the nuclear half of the national power supply by 2010, that a least-cost combination of efficient electricity use by switching fuel to gas and biomass, and environmental dispatch can together reduce the heated power output of $C0_2$ by a third and reduce the cost of electrical services by approximately one billion dollars (Canadian) for a year.

MACDONALD, John S. MacDonald, Dettwiler and Associates
13800 Commerce Parkway, Richmond, Canada, V6X 2Z9; (604) 278-3411

POLICY APPLICATIONS OF SATELLITE INFORMATION TECHNOLOGY

The concept of sustainable development, of economic improvement in harmony with the earth's biophysical system, demands that we learn to manage our activities in ways that are compatible with the sustainment and improvement of the biophysical environment of the planet. To manage our impact on the planet's biosphere requires that we develop ways of measuring the key parameters together with understanding the complex interactions which exist within it. Such a system will have its foundation in space-born measurement of the biosphere and its long term trend. This paper examines the current state of the art of measurement of the biosphere from space, and the challenges inherent in the development and implementation of such an information management system. Included is the discussion of the technology of passive and active space-born measurement of phenomena in the atmosphere and on the planetary surface.

MCGINNIS, Lloyd Wardrop Engineering Inc
Suite 300, 77 Main Street, Winnipeg, Canada, R3C 3H1; (204) 956-0980

EXPANDING OUR MARKETS THROUGH SUSTAINABLE DEVELOPMENT

The business activity which will result from the pursuit of sustainable development around the globe is destined to be enormous. This paper suggests that Canada has the capacity to become a leader in environmental technology and environmental programs. Canada is one of the few countries that has the credibility to do so and stands a good chance of success. In the process, Canadians will be encouraged to take on the global mindstead that is needed to compete in the market place of tomorrow.

MHLANGA, Liberty Agricultural and Rural Development Authority, Government of Zimbabwe
P.O. Box 8439, Causeway, Harare, Zimbabwe; (263) 4-700099

THE CHALLENGES OF SUSTAINABLE AGRICULTURE

This paper deals with the poor state of third world economic, social, environmental, population and food conditions. Optimism is expressed in that ending hunger is within reach, if the food we have worldwide can be moved or grown where it is needed. Characteristics of the Third World - why and how it has fallen into a crisis from which it seems unable to pull out - are described. Technological and other means available to pull the Third World countries out of this dilemma are offered. This paper shows how many of these problems are interlinked, are of global proportions, needing global solutions, and can be tackled systematically through a series of micro-transitions.

MOOMAW, William R. Centre for Environmental Management, Tufts University
474 Boston Avenue, Curtis Hall, Medford, USA, 02115; (617) 381-3486

POSSIBLE UNITED STATES RESPONSES TO GLOBAL CLIMATE CHANGE

Because so many different human activities contribute to global climate change, responses are likely to involve virtually all economic sectors. Since more than half of the greenhouse gas contribution is associated with the energy sector, energy efficiency and emission in relation to energy production technologies must play an important role. Because the United States is a resource rich nation, there are powerful forces that mitigate against responding in this manner. This paper explores several possible strategies that the United States may follow in responding to international agreements to stabilize or reduce greenhouse gases. The relative role of national and state governments as well as the private sector is explained.

PACHAURI, Rajendra K. Tata Energy Research Institute
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THE INDIAN PERSPECTIVE

Energy consumption in India has grown rapidly since independence in 1947, with the result that in the power sector alone installed capacity has grown from around 2000 MW in 1950 to around 6500 MW at present. Yet total energy consumption in India per capita is at a low level of a little over 200 KgOE per capita as against a level of around 8000 KgOE per capita in parts of North America. While India is attempting to curb its increase in energy demand from seven to nine percent to around six percent per annum, this presentation suggests that it is unrealistic to expect a developing country like India to even contemplate a reduction of twenty percent of CO_2 emissions in the next few decades. This paper presents quantitative analysis justifying this conclusion.

REES, William E. Planning and Resource Ecology, School of Community and Regional Planning, University of British Columbia
6333 Memorial Road, Vancouver, Canada, V6T 1W5; (604) 228-3276

THE ECOLOGICAL ECONOMICS OF GLOBAL CHANGE

Ecologically speaking, human beings differ little from other species in being fundamentally dependent for life on the sustained production of material and process resources by the rest of the ecosphere. From this perspective, all material economic "production" is in fact consumption. Such persistent global environmental trends as ozone depletion, greenhouse enhancement, deforestation, fisheries decline, and soils deterioration, are indicators that consumption by present human populations already exceed the long term productive capacity of the ecosphere. This suggests that global environmental deterioration can only be arrested through a profound re-thinking of the nature of economic process. This paper examines the ecological dimensions of global change and their potential contribution to the "greening" of economics.

ROBINSON, John Department of Environment and Resource Studies, University of Waterloo
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DECARBONATING ENERGY POLICIES: REDUCING CO_2 EMISSIONS THROUGH INCREASED ENERGY EFFICIENCY

This paper examines the amount of increased energy efficiency required to meet half the proposed 20% CO_2 reduction target in Canada by 2005. It is suggested that this will require reducing the E/GDP ratio by about 50%, and achieving something close to the full economic potential for increased energy efficiency. However, to date, conservation programs have typically resulted in achieving only about a 10%-15% of that potential. That program experience, and the behavioral literature on energy efficiency, suggests the need to radically revamp energy efficiency programs if we are to come close to achieving desired improvements in energy efficiency.

SCHIPPER, Lee Lawrence Berkley Laboratory, University of California
3125 Building 90, Berkeley, U.S.A., 94720; (415) 486-5057

SIX ENERGY TRANSITIONS: SIX ENERGY CHALLENGES

The structure of world energy demand has undergone several fundamental transitions, both because of the energy price shocks of the 1970's and 1980's, as well as in spite of those shocks. More energy is used by people, less by farms. The improvements in energy efficiency are slowing and in some cases reversing. Developing countries are responsible for an increasing share of world demand. Environment has almost replaced concern over the world oil market as the most important factor driving energy policies. Finally, the shift in the structure of demand and the concern over environment are all changing the nature of energy demand. This presentation will define these transitions and some of the implications for industrialized countries.

SZEKELY, Alberto Ministry of External Affairs, Government of Mexico
Flores Magon 1, Mexico City, D.F., Mexico, 06995; (52) 5-254-7312

INTERNATIONAL ATMOSPHERIC ISSUES: THE POSITION OF MEXICO

This paper departs from the idea that even when there is not yet sound scientific evidence on the anthropogenic harm caused to the atmosphere, the risks posed to the planet as a whole require precautionary measures to tackle this formidable challenge. In this context, the activities undertaken by Mexico are explained and some proposals are made for elements to be included in an eventual convention on climate change, giving due regard to the needs of developing countries such as Mexico.

WALKER, Brian Earthwatch Europe,
Belsyne Court, 57 Woodstock Road, Oxford, England, 0X2 6HU; (08) 65-311-600

SUSTAINABLE ECONOMICS AND ENVIRONMENTAL CHANGE

The field sciences working on a multi-disciplinary basis offer a means for understanding the secrets of nature and their complex inter-relationships. Sustainable wealth creation depends on understanding and relating to the inter-connectedness of all human activity and natural ecosystems. Satellite technology needs to be balanced by verification on the ground as we improve data and information quality. For multi-nationals the political category of "sovereignty" is inadequate. International humanitarian law offers one way forward. Third generation human rights to the natural resource base offers another.

WIDJANARKA, E.S. PAN Indonesia
c/o Indonesia (YLKI) Jl, Penbangunan I1, Duren Tiga, Jakarta, Indonesia; (21) 798-1038

ENVIRONMENTAL PROTECTION AND TRADE: INDONESIAN CASE STUDY

The island state of Indonesia is one of the most ecologically rich areas of the world. It has the second largest tropical rainforest area after the Amazon and incorporates millions of different species of flora and fauna. Environmental degradation, however, is becoming a very serious matter in the island state. This presentation looks at some of the problems facing Indonesia, and examines several approaches to solving these dilemmas.

ZOU, Jingmeng State Meteorological Administration
Baishiqiasolu, 46 Western Suburb, Beijing, People's Republic of China; telex 22094 RDSMA-CN

THE ROLE OF THE WORLD METEOROLOGICAL ORGANIZATION IN CLIMATE MONITORING

The World Meteorological Association (WMO) is on the forefront of studying the atmospheric environment. We must improve global atmospheric composition and climate monitoring and accelerate climate research in order to answer some of the very difficult questions which are being asked. WMO has two priorities in connection with atmospheric environment and climate change matters. One is to coordinate and promote international research in monitoring efforts to provide answers for the important unresolved questions of the day, and the other is to bring the developing world into our common actions to face this truly global problem.

STREAM D2
GLOBAL PROFILES

DE CARVALHO MENSES, Joao Gualberto, The Environment Agency for the State of Sao Paulo
Avenue Prof. Frederico Harman Jr., 345 Sao Paulo, Brazil 04589; (55) 11-21100

ECONOMIC DEVELOPMENT AND ENVIRONMENT: BRAZIL AND THE STATE OF SAO PAULO

The environmental problems in Brazil are front and centre on the world stage. The Amazon region has been classified as the great "World Filter" because it daily absorbs huge quantities of carbon dioxide. Using the state of Sao Paulo as an example, the author discusses the issues of water, air and noise pollution, excessive soil occupation, and the need for establishing new standards for human settlements. This presentation explains the environmental problems and suggests that the solution to this dilemma lies in addressing the social needs of the great numbers of poor who live in Brazil.

GOW, Lindsay J.A. Ministry of the Environment, Government of New Zealand
P.O. Box 10362, Wellington, New Zealand; (64) 4-734-090

COUNTRY PROFILE: NEW ZEALAND

This presentation highlights the changes made in New Zealand's institutional structures in response to serious environmental problems. These include deforestation and serious soil erosion. Since 1984, New Zealand's environmental administration has been fundamentally reviewed and restructured. New agencies have been created. Each have clear, non-conflicting objectives. This, together with reform of resource management laws, should enable effective, sustainable management.

JUNG, Jin-Sung Environment Administration, Government of Korea
#4 Pyonghwa-dong, Masan City, Kyungsangnam-co, Republic of Korea

PROFILE OF ENVIRONMENTAL PROGRAM IN KOREA

The Republic of Korea Environmental Master Plan delineates priorities and expected expenditures for environmental protection activities for air and water quality and solid and hazardous waste treatment and disposal. Total capital requirements are nearly U.S. $30.3 billion. The Korean Government's increased emphasis on pollution controls and interest in foreign technology, and its apparent interest in diversification of the import market away from Japan, is encouraging to foreign nations' marketing efforts. Custom duty exemption or reduction of import of some pollution control equipment can be obtained with advance approval of the Ministry of Environment (M.O.E.).

NASALI, Henry F. South Pacific Forum Secretariat
G.P.O. Box 856, Suva, Fiji; (679) 312-600

GLOBAL PROFILES: THE SOUTH PACIFIC PERSPECTIVE

This presentation looks at the principle environmental concerns of the South Pacific Region. These include nuclear testing, drift net fishing, dumping of radioactive and toxic waste, greenhouse effects, decommissioning of nuclear submarines, and ocean incineration of wastes. While the preceding are beyond the control of the region, deforestation, lagoon pollution from domestic waste and destruction of coastal ecosystems are the result of development within the region. This paper also examines the application of the precautionary principle as it pertains to the South Pacific's problems and looks at the means of solving the region's environmental problems.

OHASHI, Tadahiko Tokyo Gas Company Ltd.
1-5-20 Kaigan Minato-Ku, Tokyo, Japan; (81) 3-433-2111

ENVIRONMENTAL EFFECTS ON THE ENERGY ECONOMY

Today, when scientific knowledge is not completely compiled, and the cost of suppressing CO_2 emmissions are largely undetermined, we must devise a phased program of counter measures. There are many ways: a) to reduce CO_2 per unit of energy input; and b) to increase energy efficiency within the existing economical and technological framework. In this context, natural gas can play a greater role in terms of: a) its lower CO_2 emmissions; and b) a greater degree of combined cycle power generation and co-generation. To meet growing demands, especially for LNG, orderly cooperation is required among natural gas, facilities and fund suppliers and importers.

PEREZ, Rene Altamirano Department of Urban Development and Ecology
Rio Alba No. 20, Piso Colonia, Cuauhtemoc, Mexico City, Mexico 06500; (525) 553-2977

MEXICO: ENVIRONMENT AND DEVELOPMENT

This presentation discusses the Mexican Plan for Environmental Protection (M.P.E.P.). Its fundamental objectives are to harmonize economic development with environmental quality re-establishment and to promote conservation and rational utilization of natural resources. The general strategy for M.P.E.P. consists of communications mechanisms which will improve communications between society and the authorities, as well as between inter-sectoral groups.

PHANTUMVANIT, Dhira Thailand Development and Research Institute
Rujaparte Building, 163 Asoke Road, Bangkok, Thailand 10110

BUSINESS AND ENVIRONMENT IN THAILAND

Thailand's rapid industrialization over the past decade highlights the necessity for integrating industrial development with environmental and natural resources management. Integration of environmental development into business and economic development strategies is thus a necessity and cost-effective initiative. Growing environmental consciousness coupled with NGO's and media's increasingly influence on public policy issues, suggests a more stringent and costly regulatory environment in the future. However, public pressure and stricter regulations also ensure expanding, profitable markets for pollution abatement technologies and environmentally friendly products. Businesses have the financial and technical resources necessary to take a leadership role towards the integration of business development and environmental management in Thailand.

PIACENTINO, Diego Public Sector Economics Research Centre, University of Leicester
14 Salsbury Road, Leicester, England, L31 7QR; (44) 533-523-455

ITALY'S PERSPECTIVE

A global outline of environmental policies in Italy is offered, focussing on:

1) measures directed to private agents, i.e. regulations and standards aimed to build up a framework for private economic action;
2) direct action on public agencies' part, i.e. supply of services and financing of initiatives in the field of environmental management (clean-up of contaminated sites, new technologies, research, etc.);
3) business opportunities related to 1 and 2; and
4) foreseeable future development.

REED, Stuart Department of Environmental Protection, Hong Kong Government
28th Floor, Southern Centre, 130 Hennessy Rd., Wanchai, Hong Kong; 835-1001

HONG KONG: WHERE THE ENVIRONMENTAL PRESSURE IS GREATEST

This paper focuses on the threat to the environment of rapid urbanization. The urban area of Hong Kong, covering little more than 200 km² but housing over 5.5 million people as well as industries that make Hong Kong the world's 11th largest exporter, is an example of how the pressures on the environment can build up in such circumstances. The paper reviews the major environmental problems in Hong Kong and describes the HK $20 billion program being implemented to provide improved solution-control infrastructure and the legislative and planning measures aimed at solving existing environmental problems and preventing the creation of new ones.

ROUSSEAU, Edelberto A. Meteorological Services of Chile, Government of Chile
Casilla 717, Santiago, Chile; (56) 2-601-9001

CHILE'S PERSPECTIVE

This presentation begins with a summary of environmental problems in Chile. The paper then discusses various organizations (governmental and private) which are dealing with the environmental problem, the main programs being accomplished today at the national level, and finally, a perspective of the evolution that can be expected in the near future.

SIAZON, Domingo L. UNIDO
Vienna International Centre, P.O. Box 300A-1400, Vienna, Austria

GLOBAL PROFILE - UNIDO'S PERSPECTIVE

This presentation will discuss 4 different issues:

1) A summary of UNIDO's activities and mandates, its involvement in environmental issues relating to investor development, and cursory mention of the proposed UNIDO Environment Program.
2) Industrial trends in environmental issues facing the Asia and Pacific region today.
3) Description of UNIDO's ongoing and pipeline activities in the area of environment, including examples of technical cooperation projects in the Asia and Pacific region.
4) Opportunities for business and industry to assist achievement of sustainable industrial development through research and development of clean low-waste, energy efficient, recycling or reuse technology and their subsequent transfer to developing countries of Asia and the Pacific.

STREAM E1
AGRICULTURE

CHURCH, Robert B. Department of Medical Biochemistry and Biological Sciences,
The University of Calgary
3330 Hospital Drive Northwest, Calgary, Canada, T2N 4N1; (403) 220-6876

HIGH TECHNOLOGY APPROACHES TO SUSTAINABLE AGRICULTURE

The last few decades have seen tremendous advances in the development of chemically derived herbicides, insecticides and growth regulators which have maximized production and also, in many cases, profits. During this time a flourishing international bio-technology industry based on exploiting nature's reserve of unique natural events has been developed. These technological advances, including recombinant DNA, which are responsible for totally new approaches to agriculture, involving bio-regulators, bio-insecticides and herbicides and genetically engineered plants and animals offer tremendous opportunities for sustainable agriculture. Sustainable agriculture need not be equated with "going back in time".

CROSSON, Pierre Energy and Natural Resources, Resources for the Future
C/O RFF 1616 P Street, Northwest, Washington, U.S.A., 20036; (202) 328-5068

NORTH AMERICAN POLICIES AND LAWS AFFECTING SUSTAINABLE AGRICULTURE

Agricultural policies and laws in North America are, and long have been, designed to support production of food and fibre at prices which make farming profitable. The evidence is strong that the measures employed to do this have encouraged farmers to adopt chemical-intensive technologies and practises which stress the environment whilst simultaneously weakening incentives to adopt more environment-friendly practises. Changes in policies that would facilitate adoption of these alternative practises are discussed.

DEVINE, The Honourable Grant Ministry of Agriculture and Food, Government of Saskatchewan
Room 226, Legislative Buildings, Regina, Canada, S4S 0B3; (306) 787-5300

THE AGRICULTURAL INDUSTRY AND AGRICULTURAL SUBSIDIES

The global market place for agricultural produce is being distorted by agricultural subsidies, particularly on the global grain trade. Nations which rely heavily on exports, and developing countries which concentrate on the production of cash crops for foreign exchange have been hit hard by subsidies which have encouraged production even in the absence of demand, and this has hindered developments leading to sustainable agricultural systems. Humanity must develop a new sense of trust in order to overcome the political, legal, institutional and economic areas which stand in the way of the implementation of the global environmental ethic.

DONEFER, Eugene McGill International, McGill University
3550 University Street, Montreal, Canada, H3A 2A7; (514) 398-4197

PARTNERSHIP PRINCIPLE - UNIVERSITY AND OVERSEAS

This presentation discusses the network of Canadian agricultural research and educational institutions and their relationships with third world institutions. Canada gains in many ways from overseas linkages, including the supply of goods and services, and the establishment of long term mutual cooperation and business opportunities. Canadian trained graduate students return home to become leaders in government, education and business, with the potential for maintaining ties with their former institutions and teachers. This presentation illustrates some of the partnerships that Canada has with Africa, Asia and the Americas.

EGELAND, Steve Haybuster Manufacturing Inc
P.O. Box 1940 Jamestown, USA, 58402; (701) 252 4601

EQUIPMENT FOR SOIL CONSERVATION

Haybuster Manufacturing has been manufacturing conservation tillage machinery for 15 years. Due to changes in farming concepts, climatic conditions, government programs, herbicides, preference for types of equipment and machine performance, changes in machine designs have been frequent. This presentation reviews some of the technology from the concept of a conservation seed drill to present day state of the art seeding equipment.

ELKANA, Yoseph Agricultural Affairs - U.S. and Canada, Embassy of Israel - U.S. and Canada
3514 International Drive North West, Washington, U.S.A., 20008; (202) 364-5641

AGRICULTURE'S CONTRIBUTION TO PROTECTING AND IMPROVING THE ENVIRONMENT: THE CASE OF ISRAEL

This presentation deals with Israel's agriculture industry which has developed in a unique fashion due to certain geographical limitations. The presentation is broken down into two main categories. The first is the national and regional level mechanisms employs are geared towards agricultural development. The second is the village and farm level mechanism which exercises the precise farming techniques. The author also deals with certain environmentally enhancing projects, activities and effects in the agricultural community. Finally, a concrete proposal is made for the development of sustainable agriculture.

GIRT, John John Girt and Associates
#1 St. Malo, Aylmer, Canada, J9J 1J6; (819) 595-2432

PROMOTING PARTNERSHIP FOR THE SUSTAINABLE DEVELOPMENT OF AGRICULTURE - GOVERNMENT AND BUSINESS

In theory, world food production should not be constrained by farm populations, limited resources or the ability to adopt technologies that support rapid increases in output. Recent technological developments, including genetic engineering, and wider introduction of more traditional, but still advanced production techniques offer huge potential for increased food production. On the other hand, the world's natural resource base is being consumed and degraded. This presentation suggests some if the best ways for business, governments and farmers to address the three challenges of the need to develop and disseminate of production enhancing technologies, eliminate resource deterioration, and promote sustainable agricultural growth in a market oriented economy.

HARVEY, David Department of Agricultural Economics and Food Marketing,
University of Newcastle-upon-Tyne,
Newcastle upon Tyne, England, ANY1 SRU; (44) 91-222-6872

"SUSTAINABLE": ITS MEANING AND POLICY IMPLICATIONS FOR EUROPE

This presentation discusses the implications of the term "sustainable" on the agriculture industry in Europe. European policy is also examined in areas of agriculture, environmental research and in particular, the United Kingdom experience. Finally the author presents a policy framework for achieving sustainable agriculture.

HILL, Stuart Entomology Department (Faculty of Agriculture), MacDonald College,
McGill University
Box 191, Saint Anne de Bellevue, Quebec City, Canada, H9X 1C0; (514) 398-7909

ECOLOGICAL APPROACHES TO SUSTAINABLE AGRICULTURE

All of the bio-ecological problems on a farm, such as pest and disease outbreaks and soil and water degradation, can be solved or prevented by means of fine tuning of the design and management of the Agroeco system, and by taking into account all long term and distant outcomes. This approach is contrasted with short term, curative efficient use and input substitution strategies which invariably fail to confront the causes of the problem. Examples are used to illustrate this thesis.

OGDEN, Frank Agriculture Institute of Canada
c/o Contemporary Communications Ltd., 2605 Alma Street, Vancouver, Canada, V6R 3S1; (604) 688-7103

THE FUTURE OF AGRICULTURE

This presentation introduces many technological advances that will effect the economic and production processes of agriculture as we knew them in the old industrial age. As each of these technological advances is described, the author will point out the relevance of each advance and will related give information about the new globalized society and marketplace.

PIERCE, John T. Department of Geography, Simon Fraser University
Burnaby, Canada, V5A 1S6 (604) 291-3321

INTERNATIONAL REVIEW OF POLICY FRAMEWORKS

This presentation discusses the macro-economic policies which indirectly affect agriculture through exchange rates, trade and fiscal/monetary policies. While these policies are designed to fulfil specific social, economic, political and strategic objectives they are subject to trade-offs which threaten the sustainability of agriculture. In many developed countries agriculture is highly productive yet often unprofitable and harmful to the environment and to the viability of farm communities. In the developing countries the emphasis on production and export goals has often sacrificed equity concerns and the integrity of the environment to equity concerns. It is through a better understanding of the trade-offs and consequences of different agricultural policies that strategies can be formulated to move agriculture closer to sustainable modes of production.

SOEKARNO, Enclk Shaik Ahmed Ministry of Agriculture, Government of Malaysia
Kuala Lumpur, Malaysia

SOUTHEAST ASIAN POLICIES AND LAWS EFFECTING SUSTAINABLE AGRICULTURE: MALAYSIAN PERSPECTIVE

This paper argues that planners/policy makers gave priority on socio-economic development over that of environmental considerations, even up until 1980, to the neglect of environment quality maintenance including matters of sustainable development, in the agriculture sector. Specific issues are discussed, such as agricultural waste disposal, pesticides, land use, and soil conservation. The paper concludes with issues and problems in effective implementation and enforcement of the environmental regulations and laws effecting agriculture.

THOMAS, Vernon G. Department of Zoology, University of Guelph
Guelph, Canada, N1G 2W1; (519) 824-4120

NATURAL BIOLOGICAL CONTRIBUTIONS TO AGRICULTURE: REALIZATION AND ENHANCEMENT

The partial replacement of synthetic inputs by biological processes is advocated to demonstrate the lower-input, sustainable approach (LISA) to agriculture. Ways in which natural systems can be deployed to enhance soil processes, such as water flux through fields and populations of pollinating insects are outlined. These schemes have greatest relevance to production practices which are intrinsically diverse and where profitability to the producer outranks maximal yield per acre. The potential economic advantages of these systems are indicated giving scope for industry and research to integrate into LISA.

TRANT, Gerald I. United Nations, World Food Council
Via Terre di Caracalla, Rome, Italy, 00100; (396) 579-74510

FOOD SECURITY ISSUES IN A CHANGING ENVIRONMENT

This paper describes the enormous problems of global food security. From population increases to salinization, to desertification, problems have become completely unmanageable in many parts of the world. The World Food Council, which has 36 member countries, has set in motion a series of political initiatives which attempt to achieve food security for all the world's peoples by the year 2020. This paper concludes with a discussion of the goals and objectives of the World Food Council.

VERNON, Robert S. Vancouver Research Station, Agriculture Canada, Government of Canada
6660 North West Marine Drive, Vancouver, Canada, V6T 1X2

INTEGRATED PEST MANAGEMENT IN BRITISH COLUMBIA VEGETABLES: ENHANCING SUSTAINABILITY AND IMPROVING MARKETABILITY

The development of integrated pest management (IPM) programs for B.C. vegetables has resulted in dramatic reductions in pesticide use in several field and greenhouse crops. In many cases, pesticides can actually be eliminated from use in significant proportions of vegetable acreage, resulting in a healthier ecosystem, and more appealing products for consumption. By de-emphasizing pesticide use, pest resistance to pesticides can be retarded, and beneficial components of the environment can be enhanced. These are important requirements for achieving agricultural sustainability. The potential for marketing zero pesticide residue produce in B.C. is discussed.

WALTNER-TOEWS, David Ontario Veterinary College, Department of Population Medicine,
University of Guelph,
Guelph, Canada, N1G 2W1; (519) 823-8800

ONE ECOSYSTEM, ONE FOOD SYSTEM: FOOD SAFETY STRATEGIES IN A SOCIAL AND ECOLOGICAL CONTEXT

As people have emigrated from various parts of the globe, they have brought to their new home not only their intimate family relationships, but also their intimate eating habits. International trade in human foods and animal feeds amounting to billions of dollars annually support these transplanted eating habits. Infectious disease agents, toxins, and environmental contaminants of all sorts are globally distributed along these food lines. Effective food safety strategies need to be global in both spread (geographically) and depth (ecologically). The desire for democratic social controls now evident throughout the world, along with this diversity of culinary tastes, suggests that a successful global food safety strategy would do well to reflect the kind of diversity and complex interactions seen in the natural ecosystem.

WHEATON, Elaine Saskatchewan Research Council
15 Innovation Boulevard, Saskatoon, Canada, S7N 2X8: (306) 933-8179

CLIMATIC CHANGE AND THE OPPORTUNITIES IT MAY BRING

Among the factors causing climatic change, the greenhouse effect is gaining in importance. The global climate will change significantly, according to several projections. The consequences of these climatic changes will be widespread and profound. Changing regional climates may offer several opportunities that must be investigated in order to maximize benefits and minimize risks associated with these climatic impacts.

STREAM E2
FOOD PROCESSING

CARROLL, Julian P. Lawson Mardon Group
European Office, 6 Hill Street, London, England, W1E 7FU; 01-493-7323

PRODUCTION OF PACKAGING

Production of food packaging is a complex balancing act between product needs and environmental wants. The list of needs and wants is complicated by new developments in food processing, changing consumers' social and demographic patterns and concerns about waste disposal and energy consumption. This presentation presents the view that modern food packaging production is contributing to more efficient use of world resources when viewed in a "cradle to the grave" scenario. It will be shown how packaging reduces food spoilage, permits less use of preservatives, reduces nutritional deficiencies and prolongs shelf life.

CORLETT Jr., Donald A. Food Safety Review & Evaluation Services, SRE Division,
ESCAgenetics Corporation
830 Bransdon Road, San Carlos, U.S.A., 94070-3305; (415) 595-5335

IMPLEMENTING THE HAZARD ANALYSIS AND CRITICAL CONTROL POINT SYSTEM (HACCP) FOR FOOD SAFETY

The Hazard Analysis and Critical Control Point System (HACCP) was recently updated and standardized by the U.S. National Advisory Committee on Microbiological Criteria for Food (NACMCF), a committee sponsored by four federal agencies responsible for food safety. The NACMCF HACCP guidelines consist of 7 HACCP principles, descriptive information and definitions, all intended to help implement the system in the food industry. HACCP offers a major method for prevention of biological, chemical and physical hazards in domestic and world food supplies. An overview on implementation of the modern HACCP system is presented.

DENTON, Graham Product Initiatives
2200 Yonge Street, 6th Floor, Toronto, Canada, M4S 2C6; (416) 487-5757

NEW PRODUCTS IN FOOD PROCESSING

Eight out of ten new products fail. One of the reasons for the appalling track record is the evermore complex markets into which new products are introduced. More recently, environmental issues have added to the complexity of markets and to the challenges facing new products. Indeed, environmental issues question the quality of many existing products. Products that succeed in the 1990's will be those that offer consumers a significant point of difference. This presentation discusses how to ensure new products have a significant point of difference.

GRANT, Jon K. Quaker Oats Company of Canada Ltd. and Ontario Roundtable on Environment and Economy
Quaker Park, Peterborough, Canada, K9J 7B2; (705) 743-6330

CORPORATE ENVIRONMENTAL RESPONSIBILITY: WILL IT AFFECT HOW CONSUMERS BUY?

In the 1990's, consumers will make their buying decisions as much on a corporation's environmental responsiveness and record, as the brands they represent. Company identification with brands, trademarks and products, either positively or negatively, will influence consumer purchase behaviour much more than traditional individual brand and product identification. Future business leaders will need skills in social responsibility, communications and a sensitivity to changes in public environmental attitudes. "Corporate image" is the subject of this presentation.

HUSAIN, Hadi Wardrop Engineering Inc.
77 Main Street, Winnipeg, Canada, R3C 3H1; (204) 956-0980

NEW TECHNIQUES FOR FOOD INDUSTRY WASTE RECOVERY, PROCESSING AND REUSE

Increasing environmental pressures and a need to conserve energy and water have focused attention of industries, governments and researchers on recovery, recycling and reuse of food waste. Wardrop is investigating the application of new technologies to make this economical. Examples of the company's recent R&D work in food waste recovery, processing and recycling include: conversion of potato plant waste into ethanol and high protein beets; use of membrane technology in the vegetable, meat and dairy industries for water recycling and recovery of valuables; application of microwaves to convert meat industry byproducts and wastes into high value products. This paper presents the results of the R&D work.

KRENTZ, Dave Canadian Soft Drink Association
812-500 University Avenue, Toronto, Canada, M5G 1V7; (416) 979-3529

MULTIMATERIAL RECYCLING

The Canadian soft drink industry contributes to solid waste management by promoting the recycling of its containers. The industry has made proposals concerning the recycling of its containers to the governments of most Canadian provinces. The details of each proposal vary between provinces and specific examples of these proposals are described. Involvement of the soft drink industry in provincial waste management is an example of the integration of business and environmental concerns.

LEE, Graham W. Jordon (Cereals) Ltd. Holme Mills
Biggleswade, Bedfordshire, England, SG18 9JX; (44) 767-318222

GREEN PRODUCTS - CURRENT MARKETS IN THE UNITED KINGDOM: IS NOW THE RIGHT TIME?

This presentation deals with the supply side of the organic food industry. It is estimated that only a small proportion of the retail food market supply is up to organic grade with the majority still in fresh produce. This demonstrates a current gap between supply and demand. With a 3 year conversion period from standard grade to organic grade agriculture, this imbalance is unlikely to be solved in the short term. The wider implications of managing a food processing business under conditions of supply shortages will be explored. Many of the issues faced and solutions explained will be beyond the experience of the majority of traditional FMCG companies.

LOTZKAR, Ruth Environmentally Sound Packaging Coalition
2150 Maple Street, Vancouver, Canada, V6J 3T3; (604) 736-3644

CONSUMER INVOLVEMENT IN PACKAGING

This paper presents four aspects of waste management and packaging issues from a consumers' point of view. The first one is the consumer environment, which includes the home environment and the shopping/market place environment. The second one deals with consumer information and education. The third part of the presentation deals with the ongoing partnership required for better packaging. Finally, future trends are examined.

MORGAN, Barry Western Region, Health Protection Branch, Health and Welfare Canada
3155 Willingdon Green, Burnaby, Canada, V5G 4P2; (604) 666-3584

RAW MATERIAL PROCUREMENT: ENSURING A SAFE FOOD SUPPLY FOR PROCESSING

Legislation controlling pesticides, environmental contaminants, trace elements, natural toxicants and packaging materials for all food sold in Canada is contained in a Food and Drugs Act and Regulations. Health Protection Branch evaluation, inspection and analytical programs are coordinated with other federal and provincial agencies and cover both domestic and imported foods. A major goal of the Health Protection Branch is the promotion of voluntary compliance through technology transfer involving both inspection and laboratory staff, development of good importing and good manufacturing practices and conducting workshops. This presentation discusses the ramifications of some of the programs operated by the Health Protection Branch.

RAUSCH, Charlene Boulevard Communications
300 - 260 King Street, Toronto, Canada, M5A 1K3; (416) 860-0605

THE BUSINESS OF PACKAGE DESIGN: MORE THAN JUST DECORATION

Graphic design companies play an important role in helping consumer goods marketers position their products in the marketplace. This role has become more challenging with the growing, negative impact of packaging on the environment. Design companies can take a leadership position in reducing packaging wastes and selecting materials that are less harmful to the environment by incorporating effective design and material specifications into the design process, without compromising the quality or appeal of the packaging design. This presentation illustrates feasible alternatives for "overpackaged" goods and provides examples of the growing trend to focus on environmental issues as they relate to package designs.

VALENTINE, Edd Economic Development Lab, Environmental Science and Technology Department, Georgia Tech Research Institute
Atlanta, U.S.A., 30332; (404) 894-3412

MANAGING ENVIRONMENTAL CHALLENGES IN THE FOOD PROCESSING INDUSTRIES

Food processing plants are typically centralized facilities that process large quantities of raw material into a product that requires less (or no) preparation by the customer. A byproduct of the processing can be large quantities of waste materials that must be recycled or disposed of properly. Water is used extensively in processing and many of the contaminants end up in the waste water. Food processing industries rank in the top five water consuming industries in the world. Great strides have been made during the last 20 years in the treatment of these wastewaters; however, increasingly stringent regulations require additional measures. Environmental compliance by the food industry is not only mandated by regulations but required to maintain a positive public image associated with the products. This paper discusses the sources and quantities of waste along with current treatments, practices and the regulations that drive the technology. The economic factors associated with environmental compliance in future trends related to treatment technologies and regulations are also covered.

STREAM E3
ENERGY

ALLAN, John Ministry of Energy, Mines and Petroleum Resources, Province of British Columbia
617 Government Street, Victoria, Canada, V8V 1X4; (604) 387-1916

ENERGY AND ENVIRONMENT

Energy and environment are very closely linked, energy decisions concerning possible alternatives and choices are increasingly predicted on potential for mitigation of sub-environmental impact. Policy and legislation in British Columbia have resulted in careful scrutiny of project applications in the past decade. A review of existing policy and legislation in relation to environmental protection will be examined using three case studies.

ANDREWS, Clinton Analysis Group for Regional Electricity Alternatives, Energy Laboratory, Massachusetts Institute of Technology
Room E40-481, 777 Massachusetts Avenue, Cambridge, U.S.A., 02139; (617) 253-7985

THE NEW ENGLAND PROJECT: ANALYZING REGIONAL ELECTRICITY ALTERNATIVES

Conscientiousness and uncertainty have become salient characteristics of regional electric power planner in recent years. There is an effort underway to overcome these hurdles by jointly exploring different strategies for New England's electricity future. The major steak holders in the region's electric power debate, with analytic support from MIT energy lab, are examining the trade-offs between various demand and supply side options available to New England. The environmental, cost and reliability impacts of alternative strategies are being prepared in a manner that clarifies these trade-offs rather than simply providing mechanicistically - optimised "least cost" plans. MIT has developed a multi-attribute trade-up analysis technique for this consensus - building project. This paper discusses the approach, results and impacts on policy.

BURNHAM, Carole D. Ontario Hydro
700 University Avenue, Toronto, Canada, M5G 1X6; (416) 592-2947

ONTARIO HYDRO - EXPANDING THE ENVIRONMENTAL COMMITMENT

Concern for the environment is the most dynamic expression of the new social and political forces effecting government and large corporations in the last decade. Ontario Hydro's corporate policies and programs are being reviewed to determine how the company might strengthen and expand the scope of its environmental commitment. In Ontario Hydro has released its Demand/Supply plan which commands an ambitious demand management/energy efficiency program with the construction of major new supply resources. At Burrard, Hydro's new business ventures NBV division, operating in 46 countries, offers our domestic utility experience to customers seeking to develop their power systems in an efficient and environmentally responsible manner.

CONNELLY, Robert High Level Radioactive Waste, Federal Environmental Assessment Review Office, Government of Canada
13th Floor, 200 Sacre Couer Boulevard, Fontaine Building, Hull, Canada, K1A 0H3;
(819) 997-1000

ENVIRONMENTAL ASSESSMENT REVIEW OF THE CONCEPT OF DISPOSAL OF HIGH LEVEL NUCLEAR FUEL WASTE IN CANADA

In October, 1989, an Environmental Assessment Panel was appointed to review Atomic Energy of Canada Ltd.'s concept of geological disposal of nuclear fuel waste in Canada along with a broad range of nuclear fuel waste management issues. The Panel will make recommendations on the acceptability of the disposal concept and on the steps that must be taken to ensure the safe long-term management of nuclear fuel wastes in Canada. This presentation incorporates the principles of the World Commission on Environment an Development in its assessment of the environmental acceptability of the nuclear waste disposal concept. The results will likely influence future energy policy and the role of nuclear energy within it.

HASHIMOTO, Michio WP-2, IPCC
2-701 Dorfaobadai, 1-11 Aobadai, Midori-ku, Yokohama City, Kanagawa Prefecture, Japan 227

INTEGRATED POLICY EFFORTS IN ENVIRONMENT AND ENERGY FOR AIR POLLUTION CONTROL IN JAPAN

This presentation details the Japanese policy experience towards integration of environment and energy since 1962. Featured in this presentation is the growing concern over atmospheric pollution and efforts to try and solve some of these related problems. Examples are provided where public pressure has resulted in cancellation of projects and a tightening up of environmental controls in present operations.

LORRIMAM, Doug International Solar Energy Society
P.O. Box 97, Ballinafad, Canada, NOB 1H0; (416) 873-3149

SOLAR ENERGY: APPROPRIATE TECHNOLOGY

During the 1970's, when concern for the security of energy supply was an important issue in many parts of the world, a great deal of interest was generated in renewable solar energy as a long term solution to this supply problem. Now, with the environmental issues emerging as the focus of concern for the 1990's, the recognition of solar energy as both an inexhaustible and a clean energy source is once again, growing throughout the world. This presentation will provide an update on the various solar technologies, including active solar, passive solar, ???, and wind energy.

LOULOU, Richard GERARD (Group d'etudes et de recherche en analyse des decisions), McGill University
5255 Avenue Decelles, Montreal, Canada, H3T 1V6; (514) 398-4013

ENERGY/ENVIRONMENT INTERACTIONS: A SYSTEMS ANALYSIS APPROACH VIA INTER-CONNECTED DYNAMIC PROCESS MODELS

The first part of this presentation sketches a series of research projects - some underway, others for the future - they focus on the modelling and the analysis of the Canadian energy system and its multiple impacts on the environment via atmosphere commissions and transportations. The second part of the presentation is a brief summary of a series of runs of the MARKAL - Quebec model, simulating the response of the Quebec energy system to several tentative scenarios of omission restrictions. It will also comment on the important synergy resulting from a global, system-wide analysis of the problem, as opposed to a piecemeal, sector-by-sector approach

LOVINS, Amory Rocky Mountain Institute
1739 Snowmass Creek Road, Old Snowmass, U.S.A., 81654-9199; (303) 927-3851

NEW IMPLEMENTATION STRATEGIES: MAKING MARKETS IN NEGAWATTS

Past gains in energy efficiency have barely stretched the surface of savings now cost effectively available in powerful, inexpensive new technologies and new ways to finance and deliver them. Traditionally, most US electric utilities have financed customers' efficiency gains, and overcome the tenfold gap in discount rates between utilities and customers, by concessionary loans, gifts, rebates, and leases. This yields large, quick and very cheap savings. Even more promising new methods make a market in "nega-watts"; saved electricity becomes a fungible commodity that can be traded across time and space, subject to competitive bidding, arbitrage, derivative instruments, secondary markets, etc. Such markets - oriented methods, and their analogy for saving water, oil and other resources are rapidly entering successful international practise. Both old and new implementation methods appear applicable to Canada's diverse conditions.

PASSMORE, Jeff Passmore Associates International
209-135 York Street, Ottawa, Canada, K1N 5T4; (613) 234-3602

PRIVATE POWER GENERATION IN DEVELOPING COUNTRIES

The growth and demand for electric power in many developing countries is beyond the public sector's ability to respond. The World Bank has estimated the short-fall of public sector capital over the next ten years will be 45-60 billion dollars annually. This means that plants won't be built or funds will be diverted from other priority areas. There are considerable benefits for developing countries in establishing appropriate policy environment to enable private entrepreneurs to finance and build power projects of the sale of electricity to the national utility on a performance basis.

PRATER, Keith Ballard Power Systems Inc
980 West 1st Street, Unit 107, North Vancouver, Canada, V7P 3N4; (604) 263-6292

HYDROGEN FUEL CELLS: A TECHNOLOGY BREAKTHROUGH, A NEAR TERM SOLUTION

The fuel cell is an electrochemical device which converts the energy of a fuel directly into electricity. It is intrinsically energy efficient, non-polluting, quiet and reliable. Until recently, fuel cells have been expensive and comparatively large. Recent performance and cost breakthroughs in solid polymer fuel technology have made possible efficient, non-polluting power systems for distributed power generation, utility peak saving, and transportation applications. This paper describes solid polymer fuel cell technology and briefly reviews its recent performance of cost breakthroughs.

STREAM E4
OIL AND GAS

CURREN, Ken Canadian Coast Guard
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STATE OF PREPAREDNESS OF THE CANADIAN COAST GUARD TO RESPOND TO MARINE OIL SPILL

This paper explains the mechanisms that the Canadian Coast Guard has in place to respond to oil spills. Among the issues discussed are contingency planning and oil spill response preparedness.

DOWDESWELL, Elizabeth Atmospheric Environment Service, Environment Canada, Government of Canada
Canadian Climate Centre, 4905 Dufferin Street, Downsview, Canada, M3H S4T; (416) 739-4770

THE CHALLENGE OF CLIMATE CHANGE

As we enhance our understanding of the global climate system and the sensitivity of society to changes within it, we are faced with a dilemma. What actions are justified now under circumstances of imperfect knowledge? The challenge posed by the magnitude of the problem and the possible seriousness of the consequences demands creative global responses. The progress being made by the Intergovernmental Panel on Climate Change in developing a range of global strategies to enable society to limit and adapt is reviewed.

FARRAR, William G. Esso Petroleum Canada
55 Saint Clair Avenue West, Toronto, Canada, M5W 2J8; (416) 968-5070

PREVENTION, PREPAREDNESS AND RESPONSE: AN INDUSTRY PERSPECTIVE

Canada's petroleum industry has a long and creditable record of effectively managing the risks associated with marine transportation of crude oil and petroleum products. There has never been a major oil spill in Canadian waters, and the industry has demonstrated the capability to respond effectively to operational spills. However, in the wake of the Valdez incident both the down stream and the up stream segments of the industry have substantially strengthened their commitment to safe operations and protection of the environment, recognizing that the first and highest priority must be prevention. The author reports on initiatives taken, planned and proposed by the industry, both cooperatively among industry members and in cooperation with governments, and by Esso Petroleum Canada.

GOODMAN, Ron H. Esso Resources Canada Limited
Esso Resources Research Centre, 3535 Research Way, Calgary, Canada T2L 2K8; (403) 284-7489

RESPONSE TO THE VALDEZ OIL SPILL

An overview of the activities associated with the response to the Valdez oil spill during 1989 is described in this presentation. The removal of the oil from the vessel, the clean up of the oil from the water and the shore-line activities is described and the methods used are discussed. These activities are illustrated with slides and the talk is intended for the non-specialist in oil spill response.

JENKINS, Rowland H. Institute of Offshore Engineering, Heriot-Watt University
Research Park, Riccarton, Edinburgh, Scotland, EH14 4AS; (44) 31-449-3393

AN OVERVIEW OF MAJOR MARINE OIL SPILL INCIDENTS

Since the Torrey Canyon oil spill in 1967, there have been several major incidents such as the Ixtoc, Amoco, Cadiz, etc., culminating with the Exon Valdez last year. The public perception is that little or no progress has been made over the years in the ability of the oil industry and/or government to respond effectively to major marine oil spills. This paper attempts to provide and overview and assessment of what has been done to improve:

a) technical capabilities for effective response to large oil spills,
b) organization of emergency response activities,
c) knowledge about effects and recovery from impact, and
d) prediction of the fate and behaviour of oil spills at sea.

ROBERTSON, Michael Petro-Canada Inc
150-6th Avenue South West, Calgary, Canada, T2P 3E3; (403) 296-3487

WASTE MANAGEMENT IN THE UPSTREAM PETROLEUM INDUSTRY: EXPLORATION AND PRODUCTION

Waste management practises in the upstream side of the petroleum industry have evolved. Over the past several years, the industry has actively worked towards the development of a strategic approach to ensure that effective waste management direction is given to the upstream oil and gas sector. This initiative led to a unique joint industry/government approach to address waste management. Following a comprehensive study of the volume and nature of waste produced, industry established a waste management working group which developed a strategy and work programme in consultation with the government. In the fall of 1989, a major industry/government round-table meeting occurred under the Canadian Petroleum Association's leadership. This has resulted in a comprehensive work program which includes working groups on waste guidelines, six committees on waste research and five different task forces on disposal issues.

SOERJANI, Mohamad University of Indonesia
Jalan Salemba 4, P.O. Box 3442, Jakarta, 10430, Indonesia; (021) 33-0318

PRESENTATION OF ENVIRONMENTAL EVALUATION (PEE) OF OFF-SHORE OIL DRILLING FIELDS: A CASE STUDY OF JAKARTA BAY FIELDS

The Indonesian Government regulation number 29, concerning the Analysis of Impacts upon the Environment (AIUE) has been implemented as of June 5th, 1987. The regulation has a provision of a transitional period, during which on going projects must submit Presentation of Environmental Evaluation (PEE) or Study of Environmental Evaluation (SEE). Two oil companies operating off-shore oil drilling fields in Jakarta Bay have initiated studies, starting with the preparations of PEE conducted by a consultant. This presentation reveals three aspects of the study results:

1) Environmental and socio-economic defects
2) Management options for environmental control
3) Monitoring activities which were taken into account during the study period.

THOMPSON, Andrew Ferguson Gifford
Suite 500, Park Avenue, 666 Burrard Street, Vancouver, Canada, V6C 3H3; (604) 687-3216

VALDEZ: A NEW CHAPTER IN CANADIAN CONCERNS ABOUT TANKER TRAFFIC

This presentation gives a general overview of the public reaction to the oil spill threat on the west coast of Canada. The paper also describes the environmental factors effecting oil exploration and production as we move closer to the time when markets will permit resumed calls for drilling, processing and transportation of the hydro-carbon resources buried in the far north of Canada.

WHITE, Ian C. International Tanker Owners' Pollution Federation Limited
London, England; (44) 1-621-1255

MARINE OIL SPILL PREPAREDNESS - INTERNATIONAL TANKER OWNERS' PERSPECTIVE

The Exon Valdez and other recent incidents have once again projected the subject of oil pollution into the public arena and caused many people to question why, twenty-two years after the Tory Canyon accident and an enormous investment in research and development, we remain unable to deal with spilled oil in the open sea and thereby prevent it from fouling beaches and damaging wildlife on coastal resources. The truth is that the problem is much more difficult than many people are willing to acknowledge, due to a combination of factors, among the most important of which are the behaviour of oil on the sea surface and natural forces which limit the effectiveness of clean up equipment. It also has to be borne in mind that major tanker spills are rare and unpredictable events which make planning difficult. This presentation seeks briefly to explore some of the problems of combatting major oil spills from tankers from an international perspective.

STREAM E5
CHEMICALS, PLASTICS AND RUBBER

BASILLIE, David Ministry of the Environment, Province of Ontario
135 Sinclair Avenue West, 14th Floor, Toronto, Canada M4V 1P5; (416) 323-4271

THE MUNICIPAL RECYCLING SUPPORT PROGRAM

The capital and municipal Recycling Support Program (MRSP) is designed to support municipalities to recover material from the waste stream through recycling. Recycling involves domestic waste such as bottles, cans and paper and plastics being sorted by the household and collected at kerb-side by the municipality. This paper explains the Ontario Blue Box Program, and describes the expansion of some of the services to include apartment buildings and the student recycling programs at elementary and secondary schools throughout the province.

BUZZELLI, David T. Dow Chemical Canada Inc.
P.O. Box 1012 1086 Modeland Road, Sarnia, Canada, N7T 7K7; (519) 339-5092

AN INDUSTRIAL PERSPECTIVE: MANAGEMENT IN A RESPONSIBLE MANNER

This paper discusses the social and ethical responsibility of an industry in the quest for environmental stewardship and sustainable development. It examines the role of policy and legislation and recommends positive, self regulation for industrial sectors. The example of the Canadian Chemical Producers' Associations' Responsible Care Program is used to show how one industry is working to exceed existing legislation by committing to a comprehensive program to ensure the safety and health of people and quality of the environment.

CROUZILLAT, Gérard; VAN RENTERGHEN, Jaque Aérospatiale Inc.
Route de Verneuil, Les Mureaux, France 78130; (33) 34-750-396

WASTE DESTRUCTION BY PLASMA PROCESS

Due to the evolution of legislation in several countries, storage or incineration of potentially hazardous wastes is becoming more difficult; costs of disposal are increasing "correlatively". New methods of disposal based on plasma can now be considered as one answer to this problem. The interest of the plasma is its heating capacity at elevated temperatures and high energy density in reactivity, which are vastly superior to what can be obtained by conventional methods: typical temperature of an industrial plasma flow is 4000° K. Several pilot experiments have demonstrated the efficiency of the destruction that can be obtained with plasma for "difficult" wastes such as organo-halogenated compounds: plasma processes can be applied to wastes in solid or liquid form. Plasma combustion has the capacity to incinerate hazardous wastes at a lower cost than conventional methods, ensuring at the same time more complete destruction and greater safety.

EDGECOMBE, Fred Environment and Plastics Institute of Canada
1262 Don Mills Road, Suite 104, Don Mills, Canada M3B 2W7; (416) 449-3444

RECYCLING TECHNOLOGY FOR PLASTICS

Current technology for the recycling of plastics is reviewed in this presentation. Emphasis is placed on post-consumer packaging as a source of materials. Methods to collect the material, sort, clean and repossess are also discussed. Applications for recycled plastics are mentioned. The marketing of repossessed materials and products is treated through a consideration of products value in use.

FORD, Richard W. Institute for Chemical Science and Technology
265 North Front Street, Suite 106H, Sarnia, Canada N7T 7X1; (519) 336-8211

COLLABORATIVE RESEARCH IN INDUSTRIAL WASTE MANAGEMENT AND ENVIRONMENTAL QUALITY

The Institute for Chemical Science and Technology (ICST) is an industry/university consortium carrying out collaborative research of interest to its industrial members. Because of the Canadian chemical industry's commitment to sustainable development, fully 30% of the ICST research budget is devoted to projects in the areas of industrial waste management and environmental quality. This paper briefly describes ICST and highlights several of the current research projects in the area of industrial waste management. The value of this collaborative approach is assessed.

FORGRAVE, Tom Municipal Administrative Services Division, Province of Alberta,
Room 1780, 10155 102 Street, Edmonton, Canada, T5J 4L4; (403) 427-8861

BUFFER ZONES AS A SOLUTION

One method of protecting people and property from the potential risks of hazardous development is the use of buffer zones. This presentation will review the conclusions of a working group of the Major Industrial Accidents Coordinating Committee (Canada), with emphasis on the type of legislative provisions necessary in the Canadian constitutional context. The essential elements of the legislation could be adapted to any system of land use planning control.

KELLEY, Michael, T. Berkshire Inc.
7800 Foxhound Road, McLean, U.S.A., 22102; (202) 857-2960

ENVIRONMENTAL TECHNOLOGY DECISION MAKING IN THE 1990s

This presentation covers three issues:
1) the need for industry/governmental cooperation to build an environmental technology base that will meet the demands of the 1990s for the international chemical industry.
2) technology and science as a global enterprise.
3) the link between the strong science and technology base and global economic competetiveness.

KRISOR, Klaus Environmental/Nuclear Safety and Civil Protection,
Commission of the European Communities
Rue de la Loi, 200 B-1049, Brussels, Belgium; (2) 235-54-71

THE CONTROL OF CHEMICALS IN THE EUROPEAN COMMUNITY

Control of chemical substances was the first part of the European Communities environmental policy to be developed. Consequently, in 1967 a directive on classification, packing and labelling of dangerous substances was adopted. Since then chemicals control has continued to be in the forefront of legislation on environmental protection in the European community. Preventive measures have played a key role in environmental policies since 1979, when the Sixth Amendment to the classification and labelling directive set up a testing and notification scheme for new chemicals on the market and provisions for the classification and labelling of both new and existing chemicals.

MORGAN, Dave Rubber Association of Canada
308 - 89 The Queensway West, Mississagua, Canada, L5B 2V2; (416) 626-4611

SCRAP TIRES IN CANADA

Each year, approximately 240 000 tonnes of tires enter the waste stream in Canada. This is the equivalent of approximately 26 million passenger automobile tires. This presentation provides an overview of the current state of scrap tires collection, processing, and product markets in Canada. Included is a discussion of the successes and difficulties encountered by the various task forces in developing comprehensive solutions to the scrap tire problem.

RYAN, The Honourable Susan The Plastics Industry Association Inc.
41-43 Exhibition Street, Melbourne, Victoria 3000, Australia; (61) 3-654-2199

PLASTICS RECYCLING IN AUSTRALIA

Plastic waste is highly visible in the litter stream, and only a small percentage is currently recycled. As a result, plastics are under attack by the media, environmentalists, regulatory agencies and government. The Plastics Industry Association acknowledges the environmental problems related to plastics and is commited to developing long term solutions to them. Major companies in the plastics industry have contributed to a special fund and are participating in a steering committee to develop and oversee a three year program. This initiative constitutes a first industry-wide response to the statement on sustainable development by the Prime Minister of Australia.

SHORTREED, John Institute of Risk Research, University of Waterloo
200 University Ave West, Waterloo, Canada N2L 3G1; (519) 885-1211

RISK MANAGEMENT: STATE OF THE ART

Risk management is more a legislative and policy test than a technical test. The importance of attitudes, commitment, organization for safety cannot be overemphasized. The level of safety in Canada is mostly dependent on the national policy of how we allocate safety expenditures. Many more lives could be saved if a comprehensive national policy were developed. This presentation uses the chemical industry and the MIACC approaches in its discussion of safety.

SIMPSON, Ken J. Alberta Special Waste Management Corporation
9th Floor, 10909 Jasper Avenue, Edmonton, Canada T5J 3L9; (403) 422-5029

ALBERTA'S HAZARDOUS WASTE MANAGEMENT INITIATES

The province of Alberta, Canada, has implemented a number of innovative measures to control and safely dispose of hazardous waste. The Alberta Special Waste Treatment Centre near Swan Hills, is a state of the art integrated treatment facility, capable of treating any non-nuclear hazardous waste. It utilizes high temperature incineration, physical/chemical processes, stabilization and secure lands built. The centre was established with the full cooperation and consent of the local population. A liaison committee of citizens ensures an ongoing dialogue with the community and provides a mechanism for public input to the comprehensive environmental monitoring program in place in the area.

SWANSON, Elizabeth Environmental Law Centre
202-10110 124 st, Edmonton, Canada T5N 1P6; (403) 482-4891

THE PUBLIC AS ENVIRONMENTAL LITIGANTS, REFORMERS AND POLICY MAKERS

Environmentalists now have a new power as a "stakeholder" in the pollution game. As unpaid lobbyist for the public interest and a healthy and safe environment, they now claim a legitimate role in legislative, regulatory and policy making processes. Power at the ballot boxes opened the doors to the board rooms. Public concern has also sought expression and resolution in the justice system. Environmental "public interest" litigation is no longer a rare event. The public has entered the environmental arena with a vengeance as interveners, reformers, policy makers and litigants. And unless the environmental conditions which are driving public concern somehow magically disappear overnight, public concer will continue.

STREAM E6
FISHERIES AND AQUACULTURE

ALVERSON, Dayton L. Natural Resources Consultants Inc.
4055 21st St. West, Seattle, U.S.A., 98199; (206) 285-3480

NEW OPPORTUNITIES FOR FISHERIES AND AQUACULTURE IN THE TWENTY-FIRST CENTURY

World fish production from fresh water and marine areas has continued to grow over the past several decades, but much of the recent growth appears to have occurred as a result of significant gains in aquaculture. Production from wild stocks has been rather static in the Atlantic Ocean, while the Northwest and Southeast Pacific have shown rather remarkable gains. These gains, however, are the result of a strong rebounding of certain herring-like stocks. A canvass of the state of the world's fish stocks as interpreted by the food and agriculture organization of the United Nations shows that an increasing number of the world's important fish stocks are coming under heavy exploitation or are over fished. This presentation examines some of the future trends for fisheries and aquaculture.

DAVIS, John Fisheries and Oceans, Government of Canada
P.O. Box 6000, Sidney, Canada V9L 4B2; (604) 356-6515

WILD STOCK FISHERIES: OPPORTUNITIES AND CHALLENGES PER COMMON PROPERTY RESOURCES

This presentation deals with the challenges facing management of common property resources in the light of emerging global trends and harvesting, competition for limited stocks, modern technological developments and development of high seas fisheries. Important considerations are the international regimes governing the high seas, trends in world climate and the need for global cooperation in addressing common concerns. The focus of this discussion is on the North Pacific Ocean as an example of these considerations. The need for effective international mechanisms to deal with large scale problems and facilitate research is emphasized in the light of growing concern about the North Pacific ecosystem, its resources and capacities to sustain exploitation.

DONALDSON, Edward M; DEVLIN, Robert Genetics and Nutrition Section, Fisheries and Oceans, Government of Canada
4160 Marine Drive, West Vancouver, Canada, V7V 1N6; (604) 666-7928

ADVANCES IN BIOTECHNOLOGY RELATED TO AQUACULTURE AND FISHERIES

The increasing focus on the maximization of the efficency of both aquaculture and fisheries for the production of human foods containing high quality proteins and lipids has lead to the extensive application of biotechnology. In aquaculture, biotechnology is being applied to the production of monosex and polypolid stocks, the induction of spawning, the acceleration of growth and improvement of feed conversions, the diagnosis of disease, the banking of gametes, the selection of improved strains, and to the production of transgenic fish with improved production characteristics. Recombinant DNA technology is being utilized to identify specific stocks for aquaculture purposes and for the management of wild fisheries where it will facilitate the responsible exploitation of the resource.

ELVESTAD, Siri Ministry of the Environment, The Government of Norway
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THE LENKA-PROJECT: THE NORWEGIAN EXPERIENCE ON THE ASSESSMENT OF COASTAL WATERS AND RIVERS FOR AQUACULTURE

In 1987 the Norwegian government initiated a 3 year Coastal Zone Management Program called LENKA. LENKA is an effort to use the Brundtland Commission's concept of sustainable development when planning aquaculture development in Norway. A capacity model for organic loading in different types of coastal waters has been developed, and existing loadings from other pollution sources have been calculated. Thereby, one can identify suitable areas for further development of aquaculture within the limits of the natural holding capacity and the small conflicts with other user interests.

FORSTER, John Sea Farm Washington Inc.
P.O. Box 1478, Port Angeles, U.S.A., 98362; (602) 452-6244

CANADIAN/NORWEGIAN COOPERATIVE FISH FARMING VENTURES

The technology for salmon farming was developed in Norway during the 1970's. During the 1980's Canada has developed its own salmon farming industry on both east and west coasts in part by drawing on this know how through joint ventures and other forms of collaboration. Not everything has gone smoothly. There have been technical and marketing problems and opposition to the development of the industry in some areas. The current status and the future opportunities for the industry are assessed in the light of this experience.

FUJIYA, Masaru Overseas Fishery Cooperation Foundation
Akasak, Twin Towers, Akasaka-2-17-22, Minato, Japan; (81) 3-585-5381

MARINE RANCHING SYSTEM WITH AUDIO FISH TRAINING

Results of recent experiments indicate that Red Sea Bream can be trained to respond to underwater sound pulses. This has possible application to fish farming and marine ranching systems. Much like Pavlov's dog experiments, these small fish are trained to respond at feeding times to an audio sound transmitted through the water. The fish are than released into the ground where the marine ranching system is already established. The system consists of sound emitter, automatic feeder, data collector, echo sounder for fish finding and power supply. This system is connected with the control station on land by radio systems. Actual marine ranching fields are already established in several places in the southern part of Japan and it is becoming a new type of aquaculture and sea farming.

KEEN, Elmer Department of Geography, San Diego State University
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OWNERSHIP (PRIVATIZATION) AND PRODUCTIVITY OF MARINE FISHERY RESOURCES

World crises fishing began a precipitous rise in the mid 1960's. In 1960 fish ranked with chicken in price; fish on average now exceed beef and pork in price. Two inter-related factors account for this: 1) world fish stocks reached full exploitation; and 2) the common framework forced the law of supply to go into reverse. For the law of supply to work as for other commodities, ownership of the resources must move from harvester rights (tenor) to some form of sole ownership. This presentation explains why and presents options.

LILL, Alan F. Fisheries and Habitat Management, Fisheries and Oceans, Government of Canada
55 West Hastings Street, Vancouver, Canada, (604) 666-0751

NEW DIRECTIONS REQUIRED TO SUSTAIN BRITISH COLUMBIA'S WILD STOCK FISHERIES

In an effort to protect dwindling fishery stocks on the West Coast, the Department of Fisheries and Oceans is adopting a "learn by doing" approach to new policy development and implementation rather then a "grand fix." The department's plan for the 1990's is to undertake simultaneously three major but interdependent policy thrusts. Increased emphasis will be put on stewardship, rehabilitation and development of fishery's stock and their habitat. Improved harvest management and allocation policies and practices will be developed. Government of Fisheries and Oceans will also continue to work with the user groups and the public to improve consultation arrangements and to increase devolution of costs and responsibilities to those who benefit from the resource.

LOVERICH, Gary F. N.E.T. System
7910 Day Road West, Bainbridge Island, U.S.A., 98110; (206) 842-5823

A TECHNIQUE FOR OPEN OCEAN AQUACULTURE

As the aquaculture industry grows the availability and suitability of protected inshore sites will limit that growth in many areas of the world. In order for mankind to realize the tremendous potential of aquaculture as a means for providing food and livelihood, it is necessary that we move beyond the limits of sheltered and land oriented aquaculture farms. This paper describes the system of aquaculture enclosures that promises to allow the industry to expand, extend itself to more exposed sites and that will eventually lead the way into the open ocean and true mariculture activities.

MORLEY, Rob Government Relations, Fisheries Council of British Columbia
#706 - 1150 Robson St., Vancouver, Canada, V6E 1B5; (604) 684-6454

IMPLICATIONS OF THE GENERAL AGREEMENT ON TARRIFS AND TRADE AND THE UNITED STATES/CANADA FREE TRADE AGREEMENT TRADE DECISIONS ON SALMON AND HERRING FISHERIES

This paper examines the clash between a trade - directed foreign policy and sustainable development of the West Coast Fisheries Resource. Fish are no longer the common property of the people of Canada, a right acknowledged by the Law of the Sea and the Pacific Salmon Treaty, but international common property instead. Canada has abdicated its sovereign right to conserve and manage its resources, and the sad situation on the East Coast Fishery shows all too clearly what happens when you cannot count your fish accurately.

SIBERT, John Otter Research Ltd
P.O. Box 265, Station "A", Nanaimo, Canada, V9R 5K9; (604) 248-4548

STATUS OF TUNA FISHERIES RESOURCES AND MANAGEMENT

The decade of the 1980's was a period of major change in the global tuna industry. New fishing grounds and techniques were developed and the annual global tuna catch approached one million metric tonnes. The United Nations Convention on the Law of the Sea drastically altered the geopolitical context of tuna fishing. The decade of the 1990's will be a period of consolidation. Catches will stablize at levels exceeding one million tonnes. There will be major challenges and opportunities in the areas of data collection, stock evaluation, catch regulation, revenue sharing and marketing.

TAKAHASHI, Patrick Hawaii National Energy Institute, University of Hawaii
2540 Dole St., Holmes Hall 246, Honolulu, U.S.A., 96822; (808) 948-8366

TECHNOLOGIES FOR THE UTILIZATION OF NUTRIENT-RICH, DEEP OCEAN WATER FOR MARICULTURE

The state of Hawaii, with governmental and private sector partners, has developed the KEAHOLE POINT complex on the Big Island into a full spectrum research into a commercialization site for ocean resource applications. While the original focus was on ocean thermoenergy conversion (OTEC), the nutrient rich, pathogen-free cold water has found a multiplicity of uses, ranging from aquaculture to biopharmesuiticles to air conditioning and agriculture. The National Energy Laboratory of Hawaii and HAWII OCEAN SCIENCE AND TECHNOLOGY PARK combination is being consolidated into common management, and by the end of the year, could well approach a fifty million dollar investment. As many as two and possibly three power plants could be in operation by 1992: a five hundred kilowatt closed cycle system and a one hundred and sixty-five kilowatt open cycle experiment. The history of NELH maraculture applications are presented, extending to a vision for programs ranging from an ocean resource science and technology centre to stimulating the blue "revolution" through new ocean industries still on the drawing board.

THOMLINSON, Arnie United Fishermen and Allied Workers Union
Suite 160 - 111 Victoria Drive, Vancouver, Canada, V5L 4C4; (604) 255-8819

NEEDED: PROTECTION OF B.C. SALMON AT HOME AND ABROAD

B.C. salmon habitats are under attack at a rate and intensity that escalates with abuses of land, air and water. Assaults range from willful to so called "incidental", and from local to global in scope and origin. Traditional management, having failed to prevent the crisis, is increasingly seen as one of its causes. Urgently required is a new management system, having as its foundation locally elected bodies and power to make decisions on matters affecting salmon habitat, and the fortitude to vigourously defend the right of B.C.'s salmon to natural survival in the ocean.

WILSON, Thomas Technological and Ecological Services, Pacific Gas and Electric Company
P.O. Box 56, Avilah Beach, U.S.A., 93424; (805) 595-4439

COMBINING ELECTRIC POWER GENERATION WITH HIGH-VALUE MARICULTURE: BUSINESS PLAN AND FACILITIES

The utilization of warm water discharge from electric generating stations to enhance growth rates and selective aquaculture species is limited but not new. Production is often directed at mitigation of a fish species impacted by power plant operation, rather than for the purpose of commercial sale. Pacific gas and electric company investigated the potential for increasing revenues through lease of company land and unutilized resources at its electric generating stations. Through carefully analysis of aquaculture markets and technical considerations, a shell fish species was selected that had the greatest potential for a stable market position. A successful aquaculture company was then solicited to begin development of a demonstration project at a coastal generating station.

YASUNAGA, Yoshinobu Fishing and Harvesting Ground Laboratory, National Research Institute of Fishing Engineering
Ebidai Hasaki-Machi, Hasakimati, Japan, 314-04; (81) 0479-44-4961

THE PRESENT MARICULTURE TECHNIQUES FOR FISHERIES IN JAPAN

Present mariculture activities in Japan are divided into two types. One traditional which consists of a culture of seaweed and oysters. Modern techniques applied to these cultures began about fifty to one hundred years ago. Another is developing, which consists of a culture of Yellow Tails and of Scallops, and of reclamation of propagation for fishing grounds. The amount of Yellow Tail culture production has attained the level of one hundred and fifty thousand tonnes during the past twenty years. The reclamation of fishing grounds has been promoted using some types of artificial reefs to enhance fishing efficiency.

STREAM E7
TOURISM

ADAMS, Michael Environics Research Group Ltd.
45 Charles Street East, Toronto, Canada, M4Y 1S2; (416) 964-1397

THE SOCIAL AND POLITICAL ENVIRONMENT: A PUBLIC PERSPECTIVE

This presentation discusses the changing perceptions of Canadians regarding environmental issues and the use of our natural resources by the tourism industry. It includes the latest report data, as well as extensive tracking data, from two of Environics quarterly syndicated studies - the FOCUS CANADA report and the Environmental Monitor. The paper also discusses international trends and their implications for the tourism industry.

BRANCH, James Sno-Engineering Inc.
13 School Street, Littleton, U.S.A., 03561; (603) 444-4811

ENVIRONMENTAL IMPLICATIONS OF MOUNTAIN RESORT DEVELOPMENT IN NORTH AMERICA, EUROPE, JAPAN

Tourism will become a global "boom industry" in the 90's. More disposal income and discretionary time will make tourism attractive to the populace of up-scale countries; and emerging nations will recognize that tourism development is an expeditious method of bringing hard currency into these as yet undeveloped economies. Mountain resorts are efficient generators of leisure opportunity for a broad spectrum of users. Millions of visitors can be accommodated year round in an environmentally controllable manner, on a limited land allocation, and on a repetitive, non-depletive basis that has both economic and social justification. However, proper planning must recognize potential usage conflicts, cumulative effects, and off site impacts which can become matters of significant public concern, as has already taken place in Europe with the strong emergence of the Green Party.

CARELESS, Ric Wilderness Tourism Council
P.O. Box 673, Gibsons, Canada, V0N 1V0; (604) 886-8605

TOURISM AS A NATURAL RESOURCE: THE WHISTLER CASE-STUDY

While tourism is traditionally viewed as a market driven service sector, it is also dependent upon a land and water. Tourism natural resource planning builds upon established techniques used in other land based sectors such as forestry, customizing these to the market-imposed characteristics of tourism. In B.C. this has resulted in Tourism Zonation System which categorizes the land base into distinct zones accessibility of varying environmental sensitivity, assessability, development intensity, and product offerings. Working within this framework, the biophysical capability, land use suitability and economic feasibility criteria for individual tourist activity can next be identified and mapped. This presentation outlines the case study of Whistler, B.C. where this mapping approach has just been applied.

CARR, Adriane Western Canada Wilderness Committee
20 Water Street, Vancouver, Canada, V6B 1A4; (604) 683-8220

A BLUEPRINT FOR SUSTAINABLE DEVELOPMENT OF TOURISM

This presentation explores both the importance of wilderness tourism to a Canadian NGO (Non Governmental Organization), Western Canada Wilderness Committee and the ways in which the WCWC contributes to the development of wilderness tourism. The presentation challenges the commonly held notion that economic growth is necessary and good and offers a new interpretation of Bruntland's term "sustainable development" - an interpretation which stresses the ecological limits of the planet.

CLARK, Brian D. Centre for Environmental Management and Planning, University of Aberdeen,
48 College Bounds Old Aberdeen, Aberdeen, Scotland, AB9 1FX; 44-224-272353

INTEGRATED PLANNING STRATEGIES TO ACHIEVE SUSTAINABLE TOURISM DEVELOPMENT

From March 4 - 10, 1990 the Centre for Environmental Management and Planning (CEMP) is organizing a work shop in Malta to consider strategies for sustainable tourism development. The work shop, supported by WTO (UNEP), WHO, and UNESCO in collaboration with Globe '90, will focus on the complex relationships between the environment, development in tourism and, with the international speakers in participant, formulate "An Agenda For Action". The "Agenda for Action" formulated in Malta will then be presented at Globe '90. It will focus on the economic, physical, human, institutional and technical environments of tourism and will suggests how complex interrelations between tourism, environment and development might be resolved.

DINGWALL, Paul R. Department of Conservation, Government of New Zealand
59 Boulcotte St., P.O. Box 10420, Wellington, New Zealand; 64-4-710726

THE VISION - THE BALANCE AND EQUITABLE PARTNERSHIP

This presentation gives a long term view of tourism as a natural, fully integrated and influential player in the arena of environmental resource management. The principles of sustainable resource development elaborated in the World Conservation Strategy are proposed as a philosophical basis for framing policy goals and operational procedures so that tourism will contribute effectively both to the economic welfare and the quality of life of the world's people. Stress is placed upon the importance of forging strong links between tourism and resource use sectors of industry. Various mechanisms including legal, institutional, and political are examined.

HACKMAN, Arlin World Wildlife Fund
201-60 Saint Clair Avenue East, Toronto, Canada, M4T 9Z9; (416) 923-8173

INITIATIVES OF THE WORLD WILDLIFE FUND

This presentation addresses the panel topic of tourism from two vantage points:
1) WWF's experience in specific protected areas projects;
2) the strategy for the 10 year endangered spaces campaign that was launched across Canada last Fall.

HERITY, John Federal Environmental Assessment Review Office, Government of Canada
Fontaine Building, 200 Sacre Coeur Boulevard, 13th Floor, Hull, Canada, K1A 0H3; (819) 997-2254

POLICY-MAKING FOR SUSTAINABLE TOURISM DEVELOPMENT: THE ROLE OF ENVIRONMENTAL IMPACT ASSESSMENT

Achieving a balance between tourism development and the natural environment presents a growing challenge for policy makers at all levels. The Canadian Federal Government, with dual responsibility for promoting growth of the tourism industry and for fostering protection and maintenance of areas under jurisdiction, is attempting to meet this challenge, using as a foundation the concept of sustainable development. The Environmental Agenda for Canada will provide a framework for far reaching changes in environmental decision making. A key component of this initiative is the development of effective legislation for environmental impact assessment. This paper discusses the objectives of the legislation and the process by which it is being developed.

HEWSON, Peggy Canadian Parks' Service, Environment Canada, Government of Canada
10 Wellington Street, Hull, Canada, K1A 0H3; (819) 994 5793

SUSTAINABLE DEVELOPMENT FOR TOURISM FROM AN ECONOMIC AND MARKETING PERSPECTIVE

The Canadian Parks' Service, by virtue of its mandate to provide for public benefit and enjoyment and for preserving the integrity of the national resources that it is steward of, is actively involved in translating the concept of sustainable development for tourism into a working model which respects the overriding objective of resource protection. The service has recently moved even further to the international forefront of resource protection agencies in this regard with the adoption of a marketing philosophy and approach based on scientific and applied research, integrated program planning and delivery, and orientation towards building effective partnerships. The agencies experience and goals for the future is discussed with reference to specific case studies and initiatives.

INSKEEP, Edward World Tourism Organization
6529 Caminito Catalan, La Jolla, U.S.A., 92037; (619) 459-3873

SUSTAINABLE TOURISM DEVELOPMENT IN SOUTH ASIA - SOME CASE STUDIES

Two good examples of controlled tourism development representing contrasting natural and cultural environments in Southeast Asia are the Republic of the Maldives and Kingdom of Bhutam. Possessing limited natural resources but also made up of beautiful small islands, beach and marine environment, the Maldives have encouraged substantial tourism development; however, in order to control negative impact on the vulnerable environment and an orthodox Islamic society, the government limits resource development to uninhabited islands and requires that each resort be self contained, providing its own non polluting infrastructure and meeting strict standards on building and design. Bhutam, which has a firm policy for conservation of its spectacular but fragile mountain environment and traditional Buddhist culture, has taken the approach of very controlled and highly valued tourism based only on its inherent attraction; this is achieved through restricting the entry and movements of tourists, and requiring minimum expenditures, and focusing on trekking and cultural tourism.

KELLEHER, Graeme Great Barrier Reef Marine Park Authority
P.O. Box 791, Canberra, Australia, ACT 2601; (61) 62-47-0211

SUSTAINABLE DEVELOPMENT OF THE GREAT BARRIER REEF MARINE PARK

This paper describes the world's largest marine park, how it is used and how it is managed. The pressures that it must sustain and the methods used so far to ensure that it is not progressively degraded are outlined. These pressures come not only from within the park, but from governments, users of lands adjacent to the marine park and from private interest groups. These pressures are increasing rapidly but so too is our knowledge of the states and processes that sustain the great barrier reef. The changes that can be expected in the next decade are described, and suggested approaches to ensuring that development of the marine park is sustainable.

LEBLANC, Robert N. International Resource Development Corporation
132 Percy Street, Ottawa, Canada, K1R 6E1; (613) 237-6122

ECONOMIC DEVELOPMENT AND THE LINKS BETWEEN ENERGY AND ENTROPY

Besides its presence in every natural phenomenon, entropy is in every economic system and process we use in our quest to create jobs and to consume the myriad of goods and services we find so indispensable. This presentation begins with a brief and simplified version of the way that complex things are generated in nature through energy introduction. The analogy to energy and entropy is then used to show why worldwide economic development can better sustain itself by having recourse to less economically expensive resource inputs and processes such as are available through tourism. Finally, a discussion of the reasons why tourism options to economic development are so pertinent within the regional biospheres as given.

MCMULLAN, Donald E. Fletcher Challenge Canada Ltd
9th Floor, 700 West Georgia Street, P.O. Box 10058, Pacific Centre, Vancouver, Canada, V7Y 1J7; (604) 654-4707

PARTNERS IN RESOURCE USE

As a relative newcomer to industry, the tourist industry often comes into conflict with the established resource industry and an either\or philosophy of land use decision making often results. There is an urgent need for the resource and tourism industries to work together. The resource industries provide the basic essentials for human survival while the tourist industry contributes to emotional well being. In order for sustainable development to occur, all industries must plan and work together in order to make best use of the world's finite resources.

NELSON, J. Gordon Heritage Resources Centre, University of Waterloo
Room 345, Building ES1, University Avenue, Waterloo, Canada N2L 3G1; (519) 885-1211

AN ACTION PLAN FOR TOURISM: SOME COMMENTS FROM A SUSTAINABLE DEVELOPMENT PERSPECTIVE

Sustainable development is the basic philosophy upon which tourism is to be planned and developed. Sustainable development is seen as having both human or cultural and natural or environmental dimensions and tourism is seen as having impacts on both of these dimensions. A participatory approach involving tourism proponents, local people and governments is therefore considered to be necessary. Some ethical principles are also suggested for tourism in the sustainable development context. An analytical framework for planning and managing tourism in a sensitive and participatory manner is also put forward for consideration. Information and monitoring systems are stressed as essential to a sustainable development approach. Finally, it is recommended that tourism planning and management be part of national or regional conservation strategies, these being a basic coordinating tool for sustainable development.

POPOVITCH-PENNY, Sadie Northern Design and Management Limited
169 Hamilton River Road, Hydro Building, Box 913 Station A, Goose Bay, Labrador, Canada, AOP 1SO; (709) 896-2997

TOURISM AND CULTURE

Located in the northeast corner of North America, Labrador forms the eastern most portion of the Canadian Shield, and 700 miles of Canada's north east Atlantic coastline. It is a vast country which is blessed with a multitude of wildlife, breathtaking natural scenery, and much sought-after natural resources. This presentation suggests that the Inuit residents be granted the right to coordinate the development of non-consumptive wilderness adventure travel packages, and other tourist-type activities with the more traditional types of resource extraction opportunities. The paper suggests that the Inuit have a long history in managing the environment.

PRESCOTT-ALLEN, Robert World Conservation Strategy # 2
627 Aquarius Rd., RR 2, Victoria, Canada, V9B 5B4; (604) 474-1904

POLICY FRAMEWORK FOR SUSTAINABLE TOURISM DEVELOPMENT

Tourism is an economic development sector that both depends on and effects conservation of natural and cultural resources. The primary requirement for sustainable development tourism policy is securing the resource base of tourism. This is essential for the industry's future and it can also yield new business opportunities. The key elements of a sustainable tourism development policy are examined in this presentation.

THORSELL, Jim International Union for Conservation of Nature and Natural Resources
Avenue du Mon Blanc, CH-1196, Gland, Switzerland; (41) 22-649114

MAKING TOURISM SUSTAINABLE: GUIDELINES FOR ACTION

Tourism's image as a "soft-green" is not always a realistic one. Three approaches promoted by IUCN, the World Conservation Union, are presented that provide practical solutions. Firstly, conservation strategy, prepared at national and regional levels in forty-five countries have provided the cross sectional planning. Secondly, the establishment of an effectively managed system of parks and reserves are needed to protect key sites. Finally, the growth of interest in nature tourism reinforces the other initiatives while at the same time deepening the visitor's experience of the natural environment.

VAR, Turgut Texas Tourism and Recreational Program, A&M University
3020 Hummingbird Circle, College Station, U.S.A., 77801; (409) 823-1022

TOURISM AND ECONOMIC DEVELOPMENT

This paper gives an overview of economic impacts of tourism in global, regional and local settings. For decision makers, measurement of economic benefits and costs becomes a very important issue. Furthermore, the tradeoffs of economic benefits with social, environmental, and in some cases cultural costs present themselves as crucial elements of tourism planning in all settings. This paper attempts to give a planning framework that will lead to rational decisions.

STREAM E8
TRANSPORTATION

BRAGDON, Clifford R. Georgia Institute of Technology
225 North Ave., Northwest, Atlanta, U.S.A, 30332; (404) 894-8751

THREE DIMENSIONAL STRATEGIC PLANNING FOR AIRPORTS

Airports, which number nearly 20,000 within the United States, and air travel with 500,000,000 passenger enplanements are expanding rapidly. Airports and travel constitute a three dimensional resource within this biosphere. Unfortunately, we are doing at best two dimensional land use planning in a three dimensional spatial universe. Opportunities are bound to arise to plan for this environment in terms of three dimensions: air, surface, and subterranean development. Countries, governments and the private sector which take advantage of this opportunity will enhance their economic productivity while remaining sensitive to our biosphere. This paper examines creative approaches involving three dimensional spatial integration, as well as relying on all five senses (visual, auditory, olfactory, tactile and gustatory) to develop a comprehensive plan for future air transportation.

CRAMPTON, Carl Office of Marine Safety, Security and Environmental Protection,
U.S. Coast Guard Head Office
2100 2nd Street Southwest, Washington, U.S.A., 20593-0001; (202) 267 0491

THE TRANSLATION OF INTERNATIONAL MARITIME ORGANIZATION CONVENTIONS INTO REGULATIONS

The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the protocol of 1978 (MARPOL 73/78), called for action to decrease pollution of the world's oceans by ships. This paper will examine implementation of Annex One to MARPOL 73/78 in the United States by reviewing the events leading to MARPOL's 73/78 developments and its translation from international convention into US law. It also examines issues still being addressed: communication of definitions and rules, discovery of port situations not originally considered, the use of reception facilities, and MARPOL's 73/78 perceived efforts on the world's oceans.

CURREN, Ken Canadian Coast Guard, Government of Canada
P.O. Box 1013, Dartmouth, Canada, B2Y 4K2; (902) 426-3907

THE CANADA/U.S. AGREEMENT FOR RESPONDING TO SPILS (OIL AND OTHER NOXIOUS SUBSTANCES)

This paper presents an explanation of the Canada/U.S. Agreement, which exists between the Coast Guard organizations of both nations, to respond to serious spill problems in contiguous waters.

CUTHBERTSON, Robert D. Noise Engineering Research and New Airplane Development, Boeing Company Commercial Airplanes
P.O. Box 3707, Mailstop G.P.-38, Seattle, USA, 98124; (206)234-1981

AIRCRAFT NOISE REDUCTION

In the three decades that have passed since the introduction of the first jet commercial transports, aircraft noise has been a major environmental consideration. This consideration has led airports to adopt several measurements aimed at alleviating noise in their vicinity. One of these measurements has resulted in a whole new generation of a quieter airplane being produced by the world's manufacturers and placed into service by the air transport industry. These new planes provide a 15-20 decibel noise reduction over the first generation of jet plane. As the older, noisier plane are being retired from fleet service, and are replaced by the new, quieter plane, airports are beginning to experience a trend of improvement in the noise environment.

HOLLOWAY, Chris Transport 2000 Canada
22 Metcalf Street, P.O. Box 858 Station B, Ottawa, Canada, K1P 5P9; (613) 594-3290

RELATIVE FUEL EFFICIENCIES OF DIFFERENT TRANSPORT MODES

This presentation describes the fuel efficiencies of various modes of transport from three vantage points: the background, the methodology and the future. The origins of atmospheric emissions in Canada are discussed, followed by the presentation of evidence from a steering committee set up by Environment Canada to reduce nitrous oxides and volatile organic compounds emissions. Based on current quantitive and qualitative data available, a forecast for a energy efficient inter-modal transport systems is also offered.

KATZ, Richardo National Energy Commission, Government of Chilie
Teatinos 120, 7 Piso Casilia, 14-Correo 21, Santiago, Chile; (562) 698-1757

POLICY MEASURES AND TECHNOLOGICAL REQUIREMENTS FOR SUSTAINABLE URBAN GROWTH IN CHILE

In Santiago, Chile, there are major conflicts between the environmental demands of the rich and the economic, social and environmental demands of the poor. This conflict emerges in almost every environmental issue, and with special force in the transportation sector where the poor use mostly public transportation. Privately owned diesel buses (11,000) are responsible for most of the extremely high and toxic particulate matter present in the air of Santiago. They operate like a cartel in terms of fixing prices and resisting regulations. This presentation deals with the causes of this problem, the solutions that have been tried, and their effectiveness.

MESTRE, Vincent Mestre, Greve and Associates
230-280 Newport Centre Drive, Newport Beach, USA, 92660; (714) 760-0981

SCIENCE AND TECHNOLOGY OF NOISE MEASUREMENT

The science and technology of noise measurement is advancing so that monitoring can play a new role in airport planning and management. The SYSTEM approach to noise monitoring is addressed in this presentation and includes the following elements; hardware, software, statistical sampling, reporting, maintenance, and quality control. New hardware and software options provide more alternatives for reducing cost and increasing the automation of the systems. The role of noise monitoring in airport noise control programs is likely to increase as airports become more aggressive in enforcing noise abatement requirements. Examples of the use of noise monitoring data as an enforcement tool are described.

OTZEN, Flemming Baltic Marine Environment Protection Commission - Helsinki Commission (HELCOM)
Mannerheiminite 12a, Helsinki, Finland, SF-00100; (358) 060-2366

THE ROLES OF THE HELSINKI COMMISSION IN THE MARITIME FIELD - PREVENTION AND SPILL RESPONSE

The convention on the Protection of the Marine Environment of the Baltic Sea Area, 1974, Helsinki Convention, the first international convention embracing pollution from all sources, which also contained undertakings by governments to cooperate in combatting spillages, is introduced and discussed in this presentation. Achievements, future plans and lessons learnt from 16 years of regional cooperation between the governments of Denmark, Finland, The German Democratic Republic, Federal Republic of Germany, Sweden, and the U.S.S.R. are presented.

OWEN, Wilfred Brookings Institution
4539-32nd Road North, Arlington, USA, 22207; (202) 797-6000

URBAN TRANSPORT AND COMMUNICATIONS STRATEGIES TO ACCELERATE WORLD DEVELOPMENT

Inter-continental transport and communications are making the global economy a reality, but cities, which are the indispensable links in the system, are suffering from obsolete infrastructure that is frustrating the movement of people and goods, undermining economic efficiency, and destroying the living and working environment. The supply of transportation needs to be matched by measures to influence demand. Cities preparing for the 21st century will need to focus on transportation conservation through planned community design, regional growth strategies, and the use of telecommunication.

PEET, Gerard Strichting S.E.A.
Heemraadssingel 193, 3023 CB, Rotterdam, Netherlands 3023CB; (31) 10-477-9360

POLLUTION FROM SHIPS THROUGH OPERATIONAL DISCHARGES

Operational discharges by ships are a considerably more important source of marine oil pollution than are normal oil spills. Shipping incidents involving hazardous chemicals may also be an increasingly important threat to the marine environment. The media attention given to accidental oil spills could focus political attention on such spills and direct political attention from the more important sources of marine pollution such as operational discharges by ships.

PORITZKY, Siegbert B. Airport Operators Council International
1220, 19th Street North West, Suite 200, Washington D.C., U.S.A., 20036; (202) 293-8500

ISSUES INVOLVING AIRPORT CONGESTION

The problem of limited airport capacity and the resulting congestion is, in the end, a problem of success. The communities which usually own and operate airports are faced with conflicting needs - on the one hand a need to gather the economic fruits of air commerce; on the other, the need to protect airport neighbours in the community from environmental problems. This presentation describes the scope of the airport congestion problem, and the issues of noise which confront all airports. It discusses the obligations of airport operators, the economic and tactical ways to provide media capacity, and the roles of government and communities in striking the proper balance of the conflicting needs.

PURCELL, Gary Electric Power Research Institute
3412 Hill View Avenue, Pallo Alto, USA, 94303; (415) 855-2168

THE FUTURE OF ELECTRIC VEHICLES

The severe air quality problems that plague many urban areas has drawn attention to vehicles that run on "clean" fuels. Studies have demonstrated that electric vehicles (EV's) are not only much cleaner than conventional vehicles, but also the cleanest of all the alternative vehicle options. Work to develop viable, cost effective EV's is advancing, and some early models are nearing production. This presentation will examine the technology candidates for EV's, from the G-Fan-an, electric fan for commercial-fleets to the Impact, a futuristic electric commuter car. The presentation will also discuss the potential environmental benefits of EV use.

REBELLA, George John Wayne Airport
3151 Airport Avenue, K-101, Costa Mesa, U.S.A., 92626; (714) 755-6631

NOISE RESTRICTIONS AT JOHN WAYNE AIRPORT

The John Wayne Airport serves as an excellent example of how a comprehensive noise control program can significantly reduce noise impacts on neighbouring communities. This presentation addresses the Commercial Airlines Access Plan. The result of the implementation of the noise control program has been a substantial reduction in airport noise levels, both in terms of cumulative and single event noise measures.

ROBERTS, Mick The MVA Consultancy
115 Shaftesbury Avenue, London, England, WC2H 8AD; (44) 1-836-9381

SUSTAINABLE TRANSPORT POLICY: THE ROLE OF ROAD PRICING

An immediate threat to tolerable city life is posed by the ever growing intrusion of the motor vehicle. Vehicle ownership in most European countries is expected to continue to grow, yet road building on a major scale in urban areas is no longer a serious policy option. At the same time, experience suggests that public transport will not substantially alleviate congestion unless traffic restraint is introduced as a complementary measure. This presentation describes the authors' experience of assessing the potential role of restraint methods in urban transport policy, drawing particularly on their experince in road pricing. The paper draws on the results of work undertaken in cities around the world to illustrate how road pricing can fit into broader strategies for sustaining development and improving transport and environmental conditions. In conclusion, the authors speculate on the prospects for the introduction of road pricing on a major scale in Europe.

SAKAKIBARA, Yasuo Centre for American Studies, Doshisha University
Karasuma-Imadegawa, Kamigyo-Ku, Kyoto, Japan; (81) 75-251-3960

CAPACITY AND ENVIRONMENT IN THE CASE OF THE KANSAI AREA

The new runway for jet service at Osaka International Airport (OIA) was completed in 1970. The OIA is located in a recently urbanized area and the people in the vicinity have been suing the government for noise and pollution since 1969. The government has spent some 600 billion yen for environmental protection in the area out of the Airport Fund. More than 40% of the total revenue of landing and other fees of all Japanese airports (except Nareka) was spent for OIA in 1980-82. This paper deals with:

1) the nature of the environmental problems in OIA
2) the various ways the government spent money on the environment
3) cost benefits of OIA
4) the future of OIA after the new Kansai International Airport is completed
5) conflicts of interest in the consensus society are also discussed.

SUZUKI, Seigo International Association of Independent Tanker Owners, (INTERTANKO)
Gange-Rolvsg.5, 0273 Oslo 2, Norway (472) 440-340

OIL POLLUTION IN PERSPECTIVE: INTERTANKO'S VIEWS

This presentation deals with the many challenges facing the tanker industry around the world. While demands for more modern and safer vessels are being addressed by the tanker industry it is impossible to build completely safe tankers and to train utterly dependent people to man them. Furthermore, a significant part of the general pollution caused by oil spills is related to the reception facilities for oily waste which are required in order to make many of the protocols and conventions effective. Governments and not the tanker industry are partly responsible for this. Improved safety pollution prevention is probably not mainly a question of new rules, but of enforcing existing, regulations, learning from past experiences, and exchanging views and experiences within all parts of the industry.

VERNON, Bruce FuelMaker Corporation
Box 12503, 1066 West Hastings Street, Vancouver, Canada, V6E 3G3; (604) 684-4269

NATURAL GAS AND CLEAN AIR MOTORING IN THE 1990'S

This paper explores the global warming impact caused by on urban air quality and using natural gas for vehicles. The paper reviews the principal sources of atmospheric emissions, highlighting the dominant contribution of transportation. Particular attention is given to those emissions which contribute to the formation of lower atmospheric ozone, and any reactive hydrocarbons and oxides of nitrogen against this background. The economic and technical, obstacles requiring resolution before natural gas can make its contribution to air quality are identified.

VOSKRESENSKY, Konstantine I. International Martime Organization
4 Albert Embankment, London, England, SE1 7SR; (441) 587 3113

THE ROLES OF INTERNATIONAL MARITIME ORGANIZATION AND THE STATUS OF WIDER INTERNATIONAL COOPERATION

During the past 25 years, the pollution of the world's oceans has become a matter of increasing international concern. While most of the pollution emanates from land based sources, a very significant amount of pollution is caused by shipping and marine activities generally. The substances involved vary enormously in quantities transported and in the potential harm to the marine environment. The International Maritime Organization's (IMO) major function is to make shipping of all types safer, including tankers and chemical carriers. This presentation details the measures incorporated by the IMO to protect the environment.

STREAM E9
COAL

COMEAU, Louis R. Nova Scotia Power Corporation
P.O. Box 910, Halifax, Canada, B1J 2W5; (902) 428-6754

COAL UTILIZATION AND THE ENVIRONMENT

Initially, coal was utilized indiscriminantly by the public. As the use of coal evolved and became more widespread, people became concerned about coal waste products, such as fly ash and coal dust. Eventually, on a regional basis, SO_2 and NO_2 began to cause pollution concerns and the steps that utilities and equipment manufacturers took to address these problems became more important. This presentation discusses some of the newer technologies and controls in North America, Europe and certain developing countries. Global policies and programs that can be established to ensure that environmental challenges are tackled while continuing to sustain development are addressed.

HASHIMOTO, Minoru NKK Corporation
1-1-2 Marunouchi, Chiyoda-Ku, Toyko 100, Japan; (81) 3-217-2333

JAPANESE STEEL INDUSTRY'S COAL DEMAND AND ITS COAL UTILIZATION TECHNOLOGY - NOW AND FOR THE FUTURE

This presentation deals with two aspects of the Japanese steel industry's use of coal as a smelting fuel. The first is the environmental aspects of coal consumption. The second relates to the changing preference for a pulverized coal injection system which uses non-semi-soft coal.

KERCH, Richard L. Consolidation Coal Company
1800 Washington Road, Pittsburgh, U.S.A., 15241; (412) 831-4527

COAL AND SUSTAINABLE DEVELOPMENT: ARE THEY COMPATIBLE?

This presentation examines the relationship between sustainable development and coal utilization. Impediments to sustainability are discussed along with the realities of fossil fuel usage, including a brief discussion of policies.

LIVINGSTONE, Gary K. Coal Association of Canada and Luscar Limited
1600, 10235 101 Street, Edmonton, Canada, T5J 3G1; (403) 420-5810

PERCEPTION VERSUS REALITY

The public may perceive coal as an outdated, polluting fuel, of little importance to the world economy, but the reality is just the opposite. Drawing on his knowledge of the Canadian coal industry the author positions coal in its global context to set the scene for the coal stream speakers to follow. Coal is economical, safe, and abundant world wide. With new, clean coal technologies, coal is a key energy resource for sustainable development. Coal may be perceived as a fuel of the past, but the reality is that coal is vitally important to the world economy, today and in the future.

MILLER, C. Lowell Office of Clean Coal Technology, U.S. Department of Energy
FE-22, Washington, U.S.A., 20253-67150

NEW TECHNOLOGIES FOR ENVIRONMENTALLY ACCEPTABLE UTILIZATION OF COAL

The clean coal technology (CCT) demonstration program is a technology development effort jointly funded by the government and industry in which the most promising of the advanced coal based technologies are being moved into the market place through demonstrations. The demonstration effort is at a scale large enough to generate all data needed by the public sector to judge the commercial potential of the processes being developed. By making available to the public more efficient technology, the conflict between the increasing use of coal and the growing concern about the environmental impact of such use may be resolved. Of particular importance to the Department of Energy is the level of financial participation of the private sector. Although the Congress in its guidance, requires that such participation be a minimum of 50%, the participants are providing well over 60% of the funds in the cooperative agreement signed to date.

MOORE, Curtis A. The Technology Clearing House
P.O. Box 6019, McLean, U.S.A., 22106-6091; (704) 536-2414

COAL AS AN ENERGY SOURCE IN DEVELOPING COUNTRIES

Coal is the most widely distributed energy resource available to developing nations and, as their economies and populations expand, its use may increase substantially. Technologies are commercially available which use coal with substantially higher efficiencies and lower pollution rates than conventional methods. Many of these are smaller scale, flexible systems well suited to the needs of developing nations. However, these have not been widely adopted in developed nations. By adopting these technologies, developing nations can establish industrial bases which are significantly more efficient and economically superior to those of the established industrialised powers.

O'RIORDAN, Jon Ministry of Environment, Province of British Columbia
4th Floor, 810 Blanchard Street, Victoria, Canada, V8V 1X5; (604) 387-9877
MCRAE, Bruce Ministry of Energy, Mines and Petroleum Resources, Province of British Columbia
Victoria, Canada, V8V 1X4; (604) 387 6242

COAL MINING AND THE ENVIRONMENT

British Columbia produces over 20 million tonnes of coal annually. Most of this coal is produced in the southeast and the northeast coalfields of the Rocky Mountains. The exploration and development of large open pit mines and supporting infrastructure in these mountainous areas represents significant potential impact to air and water quality and to fish and wildlife habitats and populations. To cope with these problems, a blend of government regulation and industry cooperation has evolved through which a high degree of environmental management is now an accepted part of the coal mining industry.

SKINNER, Robert International Energy Agency, Organization of Economic Cooperation and Development (OECD)
2, Rue Andre-Pascal, 75775 CEDEX 16, Paris, France; (33) 1-45249890

PEOPLE, POLLUTION AND POLITICS

Two positive trends in the evolution of governing institutions must be reconciled to achieve sustainability. The first is the removal of barriers among nations and between regions both politically and especially economically. The second is the world wide growth of interest in democracy. Of all the initiatives necessary to pursue sustainability, the efficient use of energy is almost universally embraced as a sensible first choice. Yet many of the measures frequently advocated to stimulate more efficient behaviour of individuals tend to call for more - not less government intervention. OECD governments attribute recent economic growth partly to policies and structural changes that saw a reduction in government and an increased reliance on market principle. Centrally planned economies are now also actively exploring this approach.

TALLBOYS, Richard World Coal Institute
Vicarage House, 58-60 Kensington Church Street, London, England, W84 DB; (44) 1 937-4600

NATURE, MAGNITUDE AND DISTRIBUTION OF THE RESOURCE

This presentation:
1) surveys present known reserves of coal
2) details the potential for both established and new suppliers to extract coal from their reserves
3) describes the present level of world wide use of coal, and forecasts the use to the year 2000 and beyond
4) explains the relative importance of coal in the international market
5) deals with the future development of the international trade in coal, its efficiency and safety in transport and its role in promoting economic growth.

TORRENS, Ian Environmental Control Systems Department, Electric Power Research Institute
3412 Hillview Ave., P.O. Box 10412, Palo Alto, U.S.A., 94303; (415) 855-2422

COAL USE TECHNOLOGIES FOR ELECTRICITY PRODUCTION

The concept of clean coal technology has developed over the past decade as a means of reconciling the use of globally abundant energy resources with growing public and governmental concern about the quality of the environment. Its overall objective is to make this reconciliation possible in a cost effective manner by providing a broad menu of technologies adapted to the complexities of the resource itself and to the very nature of the needs of the users - electricity generation and industry. This presentation reports on the current status and future prospects of clean coal technology development, and on the role of the Electric Power Research Institute in clean coal R&D.

STREAM E10
METALS AND MINERALS

AITKEN, Roy INCO Limited
Box 44, Suite 2200, Royal Trust Tower, T.D. Centre, Toronto, Canada, M5K 1N4; (416) 361-7511

THE ENVIRONMENT IN THE 90'S - A STRATEGIC ISSUE FOR INDUSTRY

This paper addresses the paradigm shift which is occurring in business thinking on matters connected with the environment and relates it to increasing public and political awareness. It compares industry's historical reactive response on environmental issues to the current adoption of pro-active policies. Strategic decisions are being made at the top of corporations to change management systems and philosophies. The need to advise and educate the public is a new development essential to obtain public and governmental acceptance. Only through a change of perspective in environmental matters can the companies of the metals and minerals industry expect to survive.

BARTON-BRIDGES, John P. Steffen, Robertson and Kirsten (B.C.) Inc.
800 - 580 Hornby Street, Vancouver, Canada, V6C 3B6; (604) 681-4196

MINING AND THE ENVIRONMENT - THE NEED FOR ECONOMIC CONTROL OF ACID MINE DRAINAGE

Acid mine drainage (AMD) is contaminated drainage that occurs as a result of natural oxidation of the sulphide minerals contained in rock which is exposed to air and water. The release of contaminated effluents from operating and abandoned mines presents an important environmental issue with severe potential impact on surface and ground water quality. In British Columbia, a committee has been established with representatives from government, industry, and academic institutions to look into the problem of AND. A technical guide is being prepared which will provide the user with an understanding of AND and which recommends methods of predicting, controlling, and monitoring AND.

CHERRY, John A. Waterloo Centre for Ground Water Research, University of Waterloo
200 University Avenue West, Waterloo, Canada, N2L 3G1; (519) 888-4516

LONG TERM SUBSURFACE CHEMICAL CHANGES AND CONTAMINANT MIGRATION FROM CANADIAN MINE TAILINGS

Most tailings from Canadian base metal, precious metal and uranium mines contain a few per cent by weight or more of sulphide minerals. The tailings are deposited in valleys or other depressions close by dams or dykes. After the mine has been decommissioned, long term oxidation of sulphide minerals takes place in the near surface tailings. This oxidation produces sulphuric acid and a decline in PH and consequent release of transition metals, heavy metals and often other deleterious constituents. This paper summarizes the results of field studies of this long term acidification and release process at several tailings areas in canada. The paper describes the challenge facing the Canadian mining industry to diminish the rate of tailings' acidification and the long term environmental consequences of the acidification process.

CONNOLLY, Randall U.S. Bureau of Mines, Research Centre
East 315 Montgomery Avenue, Spokane, U.S.A. 99207; (509) 484-1610

MANAGEMENT OF METAL MINE WASTES

The contamination of water resources by metal mined wastes is a significant concern world wide. Existing waste management strategies and their environmental implications will be discussed. The U.S. Bureau of Mines research on permanent, economic solutions to waste management problems involving metal contaminants and acids is described. Contaminant release studies are determining which contaminants are a hazard. Control strategies are being developed and tested in the laboratory and the field.

DREDGE, Kenneth H. M.I.M. Holdings Limited
M.I.M. Plaza, 410 Ann Street, Brisbane, Australia, 4000; (61) 7-833-8000

"ENVIRONMENT" AND THE MINING AND METALS INDUSTRY - AN AUSTRALIAN PERSPECTIVE

This paper considers traditional aspects of mining and provides Australian examples of mineral exploration, technology development and research related to long term investment and operations management policies. An example of government control on the opening of new mines in environmentally and politically sensitive regions is described and the legislative approach to working conditions in the lead mining industry is discussed. The author also deals with the implications of increased recycling and other developments on metal processing marketing strategies.

ERRINGTON, John C. Reclamation, Engineering and Inspection Branch, Ministry of Energy, Mines and Petroleum Resources, Province of British Columbia
Room 105, 525 Superior Street, Victoria, Canada, V8V 1X4; (604) 356-2214

BRITISH COLUMBIA MINE RECLAMATION POLICY AND LEGISLATION

British Columbia mine reclamation legislation was first enacted in 1969 and has been relatively consistent ministry policy since then. B.C. is one of the few jurisdictions in the world where reclamation laws are administered by the ministry in charge of mining. Mine reclamation legislation requires every mine to return the land and water courses to a level of productivity and stability that existed prior to the mining. Mine reclamation policy is currently undergoing a joint government and industry review of the mines act regulations. Expected policy changes will centre around the need and mechanism for establishing a long term Mine Reclamation Fund to ensure that adequate monies are available for treatment of acid mine drainage. Also, reclamation criteria will be established in regulations.

HORSWILL, Douglas Ministry of Energy, Mines and Petroleum Resources,
Province of British Columbia
Room 406, 617 Government Street, Victoria, Canada, V8V 1X4; (604) 387-5137

A HISTORY OF ENVIRONMENTAL PROGRESS

Continuing dialogue between government, industry and labour has ensured that the mining industry in British Columbia provides a good return on investment while providing rigorous protection to the environment. Controls fall into four general categories;

1) exploration: comprehensive land use policy in place;
2) development: the Mine Development Review Process deals with potential environmental impacts of the individual operations;
3) operations: clear and comprehensive bonding requirements in place to manage environmental impact;
4) shutdown: rigorous reclamation requirements in place for all mining operations.

Future initiatives include increased public participation in decision making, state of environmental reporting from government, and a further refining of the current reclamation bonding policy.

HOWE, Bruce Energy, Mines and Resources Canada, Government of Canada
580 Boot Street, Floor 21, Ottawa, Canada, K1A 0E4; (613) 992-3456

SCIENCE AND TECHNOLOGY: A KEY TO SUSTAINABLE DEVELOPMENT

Canada is a country well endowed with natural resources and Canadians have a right to benefit from this rich inheritance. At the same time, Canadians have a responsibility to maintain a clean, healthy environment. To achieve both these goals requires that we plan and act in a much more informed way. Knowledge, through science and technology, is our key to environmentally sustainable development and resource management. Government and industry in Canada are working together to address the challenge of using air, land and water in a way which will preserve and enhance our inheritance. The Canadian experience has a lot to offer other countries in terms of both products and expertise.

JONES, Carol E. C.E. Jones and Associates Ltd.
Suite 204, 26 Bastion Square, Victoria, Canada, V8W 1H9; (604) 383-8375

MINE RECLAMATION: THE CHALLENGE

The reclamation standards in British Columbia require all mine lands to be reclaimed in a manner which ensures an acceptable productive use. Examples are given of the development of reclamation plans for mining developments, incorporating studies of regional land use and ecology to determine the most valuable end land use which can be practically achieved in the various areas of mine disturbance. The environmental conditions at B.C. mines vary greatly and often reclamation technologies can not be successfully transferred from one mine to another without testing and modification. Research programs of various mines, which have proven to be sucessful in establishing economical reclamation techniques are discussed. Some examples of large operational reclamation programs resulting from this of research and planning approach are provided.

KUIT, Walter J. Cominco Engineering Services Ltd.
P.O. Box 491, Trail, Canada, V1R 4L7; (604) 364-7118

ACID MINE DRAINAGE - ENGINEERING SERVICES TO INDUSTRY

Acid mine drainage is the most significant environmental problem in the mining industry. From a legacy of sustained environmental impact, it is now the subject of intense regulatory focus and awareness in industry. To implement effective solutions to this problem will necessitate a commitment by all engineering disciplines associated with mine development and operation. This paper reviews experience in dealing with acid drainage problems at selected mining operations. In addition, approaches to achieving drainage management at new operations are discussed.

LAFFIN, John J. Department of Mines and Energy, Province of Nova Scotia,
P.O. Box 1087, Halifax, Canada, B3J 2X1; (902) 424-4007

MANAGEMENT OF ENVIRONMENTAL TECHNOLOGY

In today's world where the needs of society, industry and the environment have to be met, solutions are the result of a multitude of disciplines being drawn together to achieve a common goal. The key to successful solutions is managing the diverse technologies that contribute to those solutions. Technical institutes such as the CIM (Canadian Institute of Mining and Metallurgy) provide a forum for the interchange of technology among the various specialists, as well as providing management in the public and private sectors with a source of special and advancing technologies.

LIGHTHALL, Peter; SELLARS, C. David Klohn Leonoff Ltd
10180 Shellbridge Way, Richmond, Canada, V6X 2W7; (604) 273-0311

ENVIRONMENTAL SERVICES TO THE MINING INDUSTRY: EXPORT OF CANADIAN TECHNOLOGIES

The development of mineral resources can result in significant local-scale changes to the environment. This impact can be minimized by careful planning for water and waste management prior to mine development, monitoring during mine operations, and design for mine closure. Klohn Leonoff Ltd has been involved in water and waste management from mines through all stages of mine development for over 30 years. A review of company participation in major mine tailings and water management projects in Canada is presented together with technology used for analysis and design. Examples of company services to various countries around the world are provided, demonstrating how environmental technology, developed in Canada, has been successfully exported.

McRAE, Bruce; O'RIORDIN, Jon Mineral Resources Division, Ministry of Environment, Energy, Mines and Petroleum Resources, Province of British Columbia
4th Floor, 617 Government Street, Victoria, Canada, V8V 1X4; (604) 387-6242

PARTNERS IN CONSULTATION

British Columbia is a major mining region, and the impact that mining has on wildlife habitats and populations can be severe. In response, the Province has developed an interesting blend of government regulation and industry cooperation to manage these impacts. The impact management strategies of all new mines or expansions are reviewed under the Mine Development Review Process, a single process by which the concerns of all government agencies are identified and addressed. A Reclamation Symposium, sponsored jointly by government agencies, universities and the coal industry, is held annually to share reclamation research results and to address issues of common concern. The British Columbia model for ensuring the environmental acceptability of coal mining is worthy of close examination by other jurisdictions.

MILLER, C. George The Mining Association of Canada
350 Sparks Street, Ottawa, Canada, K1R 7S8; (613) 233-9391

MULTIPLE USE: KEY TO SUSTAINABLE DEVELOPMENT

Are the extraction and use of mineral materials consistent with the concept of sustainability? Can the land disturbed by mining be re-used productively? Can the materials themselves be re-used? Will mineral materials inevitably become scarce and prohibitively expensive? Are we robbing future generations of options by consuming "non-re-usable" resources now? The answers to these questions are not self-evident, though they may seem to be. This paper concludes that sustainable development is achievable with respect to mineral materials, but requires dialogue and accommodation between development and conservation interests.

MORIYA, Kazue Mitsubishi Cominco Smelting Company Ltd
OHTE-MACHI Building No. 6-1, Room 906 OHTE-MACHI, 1-Chom, Chiyoda-ku, Tokyo, Japan 100; (81) 2-213-1321

ENVIRONMENTAL COMPLIANCE BY A NON-FERROUS METAL SMELTER OF JAPAN

The author served in copper, lead and zinc smelters and refineries for most of his career, and dedicated his efforts to create pollution-free smelters in the 1970's when Japan launched a strong initiative to fight against environmental problems. This presentation deals with smelting technology which complies with national and local government regulations. The presentation also challenges industry to improve technological innovations and improve contributions to make non-ferrous smelters comply with government regulations for a better environment.

PELLETIER, Clem Rescan Environmental Service Ltd
Suite 510, 1111 West Hastings Street, Vancouver, Canada, V6E 2J3; (604) 689-9460

MODERN TECHNIQUES IN SUBAQUEOUS WASTE DISPOSAL

When mining wastes contain reactive materials, the conventional practise of land based containment has often resulted in highly acidic run off from mine wastes. This has far reaching and serious environmental implications, particularly since the acid mine drainage problems may persist long after mining operations have ceased. Studies suggest that the subaqueous disposal of reactive mine wastes mitigates acid generation. This paper reviews the state-of-the-art in underwater discharge of mine wastes, including an examination of current techniques in diffuser applications to enhance dilution and dispersion of the liquids and mix tank applications in D-aeration and buoyancy control for slurry. International case studies are used for illustration purposes.

SKIDMORE, Judith NorthCARE (Northern Community Advocates for Resource Equity)
P.O. Box 1405, North Bay, Canada, P1B 8K6; (705) 495-1199

NORTHERN COMMUNITY ADVOCATES FOR RESEARCH EQUITY - AN ADVOCACY GROUP FOR REASON

Northern Advocates for Research Equity was formed in 1988 as an adhoc response to a land use dispute in north eastern Ontario, in the Tamgami forest. The group identified the need for awareness of the function and values of resource based communities addressing resource communities themselves first, and also large urban areas. The absence of a voice from the resource community results in an illusion of "emptiness" and "recreation functions" only for the land. Province-wide NorthCARE, a community coalition, promotes multiple use of Crown land as well as northern community awareness.

STIKEMAN, J. Anthony Corporation House Ltd
85 Albert Street, Ottawa, Canada, K1P 6A4; (613) 238-5678

ENVIRONMENTAL POLITICS: CORPORATE STRATEGIES

The concept of sustainable economic growth, which has been endorsed by industry, political, scientific and environmental leaders, deserves careful attention as a means of building consensus and reducing confrontations. Past industry responses to environmental initiatives are no longer effective, particularly as they have tended to dwell on the high costs of environmental protection. When evaluating environmental initiatives, industry should sensibly prioritize them and use multiple criteria. Individual companies which successfully to environmental standards and communicate effectively will enhance their credibility and competitive positioning.

ZIGARLICK, John Echo Bay Mines Ltd
3300 Manulife Place, 10180 - 101 Street, Edmonton, Canada, T5K 3S4; (403) 429-5811

THE ECHO BAY STORY: MINING IN THE NORTHERN ENVIRONMENT

Hardrock mining in the arctic tundra of Canada presents its own set of problems-environmental, logistical, technical. During the operation of the Port Radiane silver mine and more recently the Lutin gold mine, Echo Bay personnel have devised innovative solutions to the problems.

STREAM E11
THE FORESTRY INDUSTRY

ADAMS, Michael Environics Research Group Ltd.
45 Charles East, Toronto, Canada, M4Y 1S2; (416) 964-1397

SHARING THE FORESTS - A CANADIAN PERSPECTIVE

This presentation focuses on a Canadian's awareness, perceptions and attitudes regarding a number of forestry issues. Recent trends and their implications for the forest industry are discussed. The presentation deals with such areas as a Canadian's perceptions of the benefits provided and problems faced by our forests; attitudes towards the key issues in land use and forest management; public appraisal and expectations of various players in the public and private sectors with regard to preservation of the forest environment; attitudes towards government intervention in the forest industry; public need for information; and the credibility of various sources of information.

BALTER, Keith Timber Service, Resource Information Systems Inc.
110 Great Road, Bedford, U.S.A., 01730; (617) 271-0030

THE NORTH AMERICAN TIMBER RESOURCE IN THE 1990'S: DEVELOPMENT WITHIN EXPANDING ENVIRONMENTAL CONSTRAINTS

Over the past two decades, the expansion of North America's timber harvest has provided the lion's share of the world's growth in timber production. However, a continuation of this trend is unlikely in the coming decade. Strong public sentiment in Canada and the U.S. for the preservation of wilderness and wildlife has been harnessed by environmental groups in a campaign to limit timber harvesting on public lands and to further regulate commercial timber management on private ownership. Changing environmental policy in North America will place new constraints on timber availability resulting in new challenges to industry to meet the changing demand for wood products.

BISHOP, David Natural Environment Research Institute, Institute of Virology, Oxford University
Mansfield Road, Oxford, England, OX1 3FR; (44) 865-51-23-61

PEST AGENTS: MOVING FROM CHEMICAL TO BIOLOGICAL PEST CONTROL

A variety of biological materials have been evaluated for pest control in agricultural and forest ecosystems. These include parasitoidal insects, fungi, nematodes, bacteria and viruses. Short and long term protection of pests has been demonstrated using specific viral insecticides. Examples in use in the U.K. include viruses of the pine soft fly and pine beauty moth. Some of these viruses are as cost effective as other forms of control (eg. chemicals). Others are marginally more expensive but are more acceptable due to the species specificity and lack of effect on the food chain. Research to develop virus insecticides as more effective control agents using genetic engineering procedures is under way and will be discussed.

BOURGEOIS, Bill MacMillan Bloedel Ltd
65 Front Street, Nanaimo, Canada, V9R 5H9; (604) 755-3419

COASTAL FORESTRY AND FISHERIES GUIDELINES IN BRITISH COLUMBIA

The Coastal Fisheries/Forestry Guidelines were developed jointly by industry and government agencies to assist fisheries and forestry operators to manage the two resources in an integrated manner. The guidelines were developed within a technical and policy committee structure and included research data and operational experience information. The information is presented with a statement of principle and a format that allows interpretation for the great number of site specific conditions that exist in coastal B.C. watersheds. The training program and follow-up evaluations are integral parts of the guidelines. They provide the understanding and add credibility to the documents.

CARSWELL, Robert Wildlife Habitat Canada
1 Place Ville-Marie, Suite 3900, Box 70, Station B, Montreal, Canada, H3B 4M7; (514) 878-8806

INTRODUCING THE SESSION THEME: "SHARING THE FORESTS"

As a country, founded on natural resources including fur, fish and timber, Canada still has the enviable opportunity of managing its future forests for a multitude of benefits. With the heavy exploitation of wood products over the past 50 years, Canada has reached a cross-roads in forest management. Should we continue to enhance short term wood supply or develop a longer term management strategy? With current public concern and environmental awareness, Canada must review alternative management strategies, define those that truly provide sustainable benefits to society and start to define our future forest landscapes. We are fortunate to be able to examine other more developed forest management situations around the world while we still have such a resiliant forest land base.

CHELIAK, William Department of Forestry, Government of Canada
Science Directorate, 351 St. Joseph Boulevard, Hull, Canada, K1A 1G5; (819) 997-1107

EMERGING TECHNOLOGIES IN FORESTRY MANAGEMENT: BIOTECHNOLOGY

Biotechnology, through tissue culture, molecular genetics and genetic engineering, is in the early stages of development in plant biology. However, within this decade, it is expected that biotechnology will have major impacts on advanced plant improvement programs, including forestry. The recent success in producing artificial seeds of many conifers, means it will be possible to more rapidly increase forest productivity through tissue culture and cloning. Using this tissue culture system, gene resources can be stored and protected at ultra low temperatures. Molecular genetics provides the basic tool for identification, isolation, and characterization of gene products. Genetic engineering provides a means of deliberately introducing new genetic information from essentially any species, into an already improved population. Thus, the forest geneticist ultimately has a greater pool of genetic diversity to improve the forest.

CLARK, David European Paper Institute
42 rue Galilée, Paris, France, 75116; (33) 1-472-04383

RECYCLING IN EUROPE

This presentation explains some of the hopes and problems associated with the vast increase in recycling of paper products in Western Europe. Among the issues discussed is the danger that misconceived government involvement in search for green votes could actually hinder rather than help the increase in recycling.

FOLKMANN, Paul Weldwood of Canada
129 Switzer Drive, Hinton, Canada, T7V 1B7; (403) 865-8178

FOREST MANAGEMENT IN ALBERTA: ONE COMPANY'S SUCCESS STORY

Weldwood of Canada (Hinton Division) operates a soft wood bleached craft pulp mill and a soft wood dimension lumber mill in Hinton, Alberta. A forest management area of about one million hectares of public land is managed by company foresters under a renewable Forest Management Agreement with the Province of Alberta. Responsibilities for integrated resources management on a sustainable basis are shared between the provincial government and the company. A stable political climate offering security of land claims coupled with far-sighted forest management practices, have resulted in a 35 year success story. Future challenges and opportunities will require continued cooperation and foresight.

FRENCH, Tony Forintek Canada Corporation
6620 North West Marine Drive, Vancouver, Canada, V6T 1X2; (604) 224-3221

SOLID WOOD INDUSTRY DEVELOPMENT IN CANADA

Producing more with less is becoming an essential theme for the technological advancement of the Canadian wood products industry. Many advances have been made in manufacturing and consumption of wood products. Many opportunities lie ahead for market-oriented solutions to environmental challenges. This presentation discusses some of the future options and opportunities for the wood products industry.

GODBOUT, Claude Faculty of Forestry and Geomatics, Laval University
Quebec City, Canada, G1K 7P4; (418) 656-2116

LAND USE ISSUES IN CANADA

This presentation gives a brief overview of Canada's forests and their management, followed by a discussion of the current situation regarding environmental concerns in Canada's forests with particular emphasis on land use conflicts. A general synthesis of the various issues in different regions of Canada regarding the management of forest land use carried out and key questions that arise are identified.

GRANQVIST, Ake Stora Forest
S-79180 Falun, Sweden; (46) 23-80101

LAND USE CONFLICTS IN SWEDEN

Although forestry in Sweden dates back to the 16th century, modern forestry began with the passing of the forestry act in 1903. Through mechanization and large scale operations, started during the 50's, the conflict between the industrial forest and nature conservation became evident. Since then the multiple use of forest lands has been stressed. While the concept of integrated use of forest land has been accepted by all parties, there are still many conflicts to be solved. This paper outlines some of the mechanisms that are used to solve these conflicts.

GRANT, Gordon E. Pacific North West Research Station, U.S Forest Service
3200 Jefferson Way, Corvallis, U.S.A., 97331; (503) 750-7328

THE NEW FORESTRY

"New Forestry" refers to an emerging set of perspectives in associated practices for conducting ecologically sound and sustainable forestry. The basic philosophy is that forests should be actively managed for diverse values, including timber, wildlife and other ecological values. Three spacial scales are considered; stand, landscape, and drainage network. This presentation discusses the implications of these three spacial scales and the effect that emerging technologies and computer based modelling and geographic information systems will have in planning for and applying these concepts over large and diverse regions.

KAUMAN, Walter G. Department of Timber Engineering, Universidad del Bio Bio
Casilla 5-C, Conception, Chile; (56) 41-238984

SUPPLY AND DEMAND TRENDS IN LATIN AMERICA

Latin America owns half the world's remaining tropical forests and also has extensive plantations of pines and eucalyptus. The latter are increasing through intensive planting programs, whereas some 0.4% of the former are destroyed annually, mainly as a result of land speculation, official settlement programs, unauthorized squatting of landless poor, clearing for cattle ranching, and removal of wood for fuel. The conservation of forests to safeguard the ecological environment requires determined political action to stop speculation and other forms of non-productive depredation. This presentation details some of the factors involved in future management of Latin American forests.

KIMMINS, J.P. (Hamish) Department of Forest Sciences, University of British Columbia
Vancouver, Canada; (604) 228-3549

THE FUTURE OF FORESTED LANDSCAPES IN CANADA

The 1990's will be the decade in which a new strategy is developed for the management of our forested landscapes in the 21st century: it will be a strategy that addresses the needs of the 1990's and is able to respond with flexibility to probable future needs. The foundation for this new strategy must be diversity. It must recognize the mosaic of climate, soils and landforms that defines the mosaic of potential vegetation, the associated potential wild life habitat, and the recreation potential. It must also recognize the great variety of economic needs which will originate from this land base.

KOURTZ, Peter Great Lakes Forestry Centre, Department of Forestry, Government of Canada
Petawawa National Forest Institute, Chalk River, Canada, K0J 1J0; (613) 589-2880

IMPROVING FOREST PROTECTION WITH NEW TECHNOLOGIES: A FOREST FIRE DECISION SUPPORT EXAMPLE

Protection of forest resources from losses to fire, insects and disease is a vital component of an environmentally sound sustainable development policy. This paper illustrates how modern technologies can be focused to solve the forest fire loss problem. The integration of computer science, geographic information systems, operations research, remote sensing, and artificial intelligence into a decision support system designed to manage a highly centralized fire control operation in a large forest region are described.

LYONS, Michael J. Asia Pacific Forest Industries Magazine, Safan Publishing
#2403 - 24th Floor, Plaza See Hoy Chan, Jalan Raja Chulan, Kuala Lumpur, Malasia,
50200; (60) 3-238-4411

IS DEVELOPMENT SUSTAINABLE?

On present evidence, and with the current state of technology, the answer to "Is development sustainable?" is a very clear "no". With changes in social and economic efficiency and improvements in technology, however, developments may be sustained in certain areas. This presentation details some of the opportunities for improving the current state of technology, and thereby, giving new life to the world's economic systems.

MCCLAY, Brian Canadian Pulp and Paper Association
Sunlife Building, 19th Floor, 1155 Metcalfe, Montreal, Canada, H3B 4T6; (514) 866-6621

PAPER RECYCLING IN CANADA: AN ESTABLISHED PRACTICE ON THE VERGE OF SIGNIFICANT GROWTH

Canada has become the world's largest newspaper producer and exporter and an important supplier of printing and writing papers because of the superior quality of wood and the market's general preference for virgin fibre paper. This preference is changing and many North American Customers are now demanding more recycled contents paper, particularly newsprint. The industry's plans to satisfy this new demand mark the beginning of a period of significant change characterized by large capital investments, new sources of fibre, additional transportation requirements, increased emphasis on product and process research, and perhaps increased competition from new producers established closer to the sources of waste paper. The key issue addressed in the presentation will be the extent to which market forces are allowed to regulate the process.

MOEN, Andrea Milner and Steer
2900 Manulife Place, 10180 - 101 Street, Edmonton, Canada, T5J 3V5; (403) 423-7306

LAND USE ISSUES IN CANADA'S FORESTS: THE CASE OF ALBERTA

As a follow up to Doctor Godbout's presentation on the general issues of land use conflicts in Canada's forests, this presentation covers Alberta as a specific case, and discusses Alberta's integrated resource planning model for planning for sharing the forest resource.

MOK, Sian Tuan Association of South East Asian Nations (ASEAN) Institute of Forest Management
Kuala Lumpur, Malaysia; (60) 3-442-9251

ASIA PACIFIC FOREST RESOURCE TRENDS AND ENVIRONMENTAL CONSIDERATIONS

The Asia-Pacific regions have been degraded or transformed rapidly to satisfy the basic needs of the growing population and the insatiable demands for tropical hardwoods and commodities. Natural forest depletion will continue but the downward trend will be checked by environmental considerations. However, forest resource trends can be stabilized and even reversed by more efficient utilization, intensive management and plantations. This paper outlines some of the challenges and opportunities for forest management in the Asia-Pacific Region.

MUMPER, David Timberlands Resource, Weyerhaeuser
Tacoma, Washington, U.S.A., 98477; (206) 924-3548

REALIZING OUR COMMON FUTURE THROUGH CONSENSUS MANAGEMENT OF FOREST RESOURCES: WASHINGTON STATE'S TIMBER, FISH AND WILDLIFE AGREEMENT

Conflicts precipitated by perceived environmental and economic impact resulting from forest resources management have plagued Washington State since the early 1970's. Forest resources include fish, wildlife, timber and water. A management benefit to one resource has been viewed as a cost to another resource. To ease the contentious attitude between environmentalists and foresters, a negotiated agreement called the Timber, Fish and Wildlife Agreement (TFWA) was signed between the timber industry, non-industrial private land owners, the treaty tribes, the state resource agencies and the environmental community. This presentation explores Weyerhaeuser's experiences and provides suggestions on how to use the cooperative dispute resolution process which has developed under the TFWA over the past three years.

NILSSON, Sten International Institute for Applied Systems Analysis (IIASA)
Schlossplatz 1 A-2361, Laxenburg, Austria; 02236-715210

FOREST RESOURCE TRENDS - A EUROPEAN VIEW

The IIASA Forest Study has been underway since March 1986, addressing the future development of the forest resources in Europe. This paper will present the following:

1) basic development of the forest resources in Europe for the next 100 years and the development of the potential supply of industrial round wood;
2) quantification of the possible effects of air pollutants on the European future potential wood supply;
3) policy implications of the findings in the quantitative analysis.

OGASAWARA, Hidenbou Clean Japan Centre
3rd Floor, #2 Akiyama Building, 3-6-2 Toranomon, Minato-Ku, Tokyo, Japan, 105;
(03) 432-6301

THE PRESENT STATE OF WASTEPAPER RECYCLING IN JAPAN AND FUTURE PERSPECTIVES

In 1988, wastepaper recovery rate was approximately 49% for Japan. Traditionally, wastepaper recovery systems have been relatively popular and well established in Japanese society. Among the potential waste designated for source separation and group collection programs practised by local governments and community groups, many communities separate and collect waste paper as resourceful waste. In addition, local governments as well as private companies have initiated their own minimization and recycling programs for waste-papers produced in their offices. This paper deals with three problems relating to the promotion of waste-paper recycling:

1) the supply and demand of low quality and high quality waste paper;
2) separation of waste paper from business offices; and
3) vulnerability of the waste paper market to the international market.

SCHOTTE, Lennart Royal Swedish Academy of Agriculture and Forestry
P.O. Box 6806 S-11386, Stockholm, Sweden; (46) 8-736-09-00

SUSTAINABLE FORESTRY PRACTICES IN SCANDINAVIA

The Scandinavian forest industries are major net exporters and, as such, are decisively important to the overall economy of their nations. From an environmental standpoint, the industries have had success in reducing DOD-substances and effluents, the rate of particles and sulphur dioxide emission, and they have also been successful in establishing cost effective control programs. They have not had success, however, in addressing certain other environmental problems, such as the bleaching process, the biological long term effects of pollution, the energy balance, and the necessity to apply an overall view with respect to the techniques relating to economy, ecology and environmental protection. This paper discusses the successes and the challenges which face the forest industries in Scandinavia.

STANYER, Roger I.W.A. - Canada
351 Brae Road, Duncan, Canada; (604) 746-6131

LAND USE TRADE-OFFS IN ENVIRONMENTAL CONSERVATION AND RECREATIONAL USES

This presentation discusses some of the trade-offs that are not generally considered in the public debate about the environmental/conservation/recreation issues to forest lands of British Columbia. For example, given the need for some minimum forest harvest, globally, nationally and regionally, will a decision to "preserve" a given area of timber merely shift production pressure to some other land where that pressure will result in greater environmental/conservation losses? Does the "wilderness recreation" interest intervene in these issues to the detriment of the environment? If areas of the world that can afford to reduce production of physical goods do so by adopting a series of measures, each of which have the result of using land less intensively, will that not result in poorer areas bearing a greater and greater proportion of the environmental stress associated with supporting human life - that is, forcing more and more intensive use of the land of poorer countries?

VALENTINE, John Ministry of Forestry, Government of New Zealand
P.O. Box 1610, Wellington, New Zealand; (64) 4-721-569

LAND USE IN NEW ZEALAND: A FORESTRY PERSPECTIVE

Most of New Zealand's export earnings come from land based industries. This paper summarizes the evolution of land use since the treaty of Waitangi was signed. There have been phases of indigenous forest exploitation, major afforestation and, in recent decades, with continued expansion of the productive land base and the adoption of multiple use policies, farming/forestry and conservation/development conflicts. But economic restructuring has resulted in dramatic changes in forestry. The radiata cline resort provides opportunities for industrial expansion, relatively reduced dependence on agriculture, conservation of the indigenous estate and the redressing of treaty grievances. A more mature landscape will result.

VERTINSKY, Ilan Forest Economics and Policy Analysis Research Unit, University of British Columbia
2260 East Mall, Vancouver, Canada, V6T 1Z8; (604) 228-3886

THE ECONOMIC POINT OF VIEW: THE NEED TO CONSIDER COST AND BENEFIT TRADE-OFFS IN MANAGING THE FOREST FOR SUSTAINABILITY

Popular belief holds that the economic framework for analysis is myopic and focuses only on timber values of the forests. In this presentation we argue that the only framework which can assure sustainable development is sound analysis based on explicit recognition of trade-offs between timber and non timber use values of the forests, as well as non-use value such as option and existence value. Indeed, without the recognition of costs and benefits trade-off a management regime cannot be sustained and, therefore, cannot achieve sustainable development.

WARDLE, Phillip Forestry Department, Food and Agriculture Organization, United Nations
Via del Terme di Caracalla, Rome, Italy, 00100; (39) 657973302

WORLD VIEW OF SUPPLY AND DEMAND TRENDS FOR FORESTS PRODUCTS IN THE ENVIRONMENTALLY CONSCIOUS 1990's

Forests are important for vegetation cover around the globe and the supply of economic goods and conservation services. The demand grows while the supplies are constrained or reduced by population pressure and the pressure of other uses and external input. For developing countries, FAO coordinates the international initiative - the Tropical Forest Reaction Plan to mobilize sound plans and resources. In all countries achieving the greater contribution of forests and forest industry to the economy and environment requires sensitive management responsive to the demands of the forest in all its roles.

ZIMMERMAN, Adam Norlanda Forest Inc.
P.O. Box 7, Toronto Dominion Centre, Toronto, Canada, M5K 1A1: (416) 982-7120

ECONOMIC AND ENVIRONMENTAL IMPERATIVES IN THE FORESTRY INDUSTRY

This presentation deals with the lack of generally accepted data and processes for resolving divergent positions that relate to the economic and environmental imperatives with which our society is faced. Comparisons will be made between the regimes in unitary countries, federations and lesser developed countries.

STREAM F1
WASTE MANAGEMENT

ARCHAMBEAULT, Pierre JPA Appliances
776 Kingsway Avenue, Vancouver, V5V 3C1, Canada; (604) 879-1555

FREON RECOVERY FROM APPLIANCES

The release of freons to the atmosphere accounts for almost half of upper atmosphere ozone depletion. A major source of freon release is associated with the disposal and repair of refrigeration appliances and systems - both residential and commercial. In British Columbia alone, approximately 67,000 refrigerators, 20,000 freezers and a similar number of air conditioners were removed from service for disposal in 1989. JPA Appliances of Vancouver has developed a unique, economical and mobile freon recovery unit that eliminates loss of freons from disposed units at municipal dump sites, appliance repair facilities and commercial locations. An environmentally responsive business opportunity exists in the manufacture and sale of freon recovery units, training for appliance repair; freon removal service from discarded units, used appliance inventory and parts recycling.

BARRAT, Olga A. Barrat and Associates
#340-1425 Marine Drive, W. Vancouver, Canada, V7T 1B9; (604) 922-4061

PLASTICS: ENVIRONMENTAL ASPECTS OF NON-DEGRADABLE AND DEGRADABLE POLYMERS

As the world population expands, the demand for plastics is increased. However, the increased quantities of plastics present one of the major problems of pollution in the environment. The cost of waste management in every community is rapidly escalating and the second largest part of solid waste is disposable plastics. There are three main ways that plastics can be degraded: 1) total degradation; 2) oxidative degradation; 3) biodegradation. This paper reviews the environmental aspects of these three categories of plastics.

BRACKER, Gerd-Peter W. MAB-Lentjes Energie-Und Umwelttechnik GmbH
Ratingen, West Germany; (49) 2102-922974

A WASTE TREATMENT CENTRE IN A RURAL DISTRICT

By application of a combination of mechanical, biological and thermal processes, municipal and agricultural waste is treated individually, thus producing high quality compost and isolating energy carriers. These are rdf, biogas, and fermenter sludge. They are then combusted for district heating in the generation of electricity. This paper discusses the technical aspects of this form of waste treatment centre, especially systematic waste disposal, environmental protection, and recycling of raw materials for energy production.

BRADLEY, Ken C. Ontario Waste Management Corporation
#2 Bloor Street West, 11th Floor, Toronto, Canada, M4W 3E2; (416) 923-2918

BARRIERS TO WASTE REDUCTION: A GLOBAL PERSPECTIVE

A study by the Ontario Waste Management Corporation into barriers to reduction, recycling and exchange and recovery of hazardous and liquid industrial wastes found these to be essentially economic, technological, informational and regulatory in nature. Subsequently, OWMC published a waste audit and reduction manual and now conducts workshops across the province as part of the company's recently expanded waste reduction program. The program is primarily directed at the informational barrier, but the attitudinal barrier in industry is also approached. The universality of these barriers and steps that can be taken to lower them are discussed.

BRESCHI, A.C. Azienda Municipalizzata di Igiene Urbana
Via Galcianese 15, Prato, Italy, 50047; (39) 57429224

RECYCLING OF UNSORTED AND CONTAMINATED WASTE PLASTIC IN BITUMINOUS CONGLOMERATE

A.S.M.I.U. evaluated the possibility of recycling plastics from solid urban and industrial wastes. While markets were easily found for homogenous plastics it was more difficult to find uses for unsorted plastics of various types. The company tested the utilization of unsorted plastics in the making of bituminous conglomerate for building streets and squares to replace a percentage of the bitumen. The positive results of this have led to proceeding with industrial production.

HANLEY, M.J; LAUGHLIN, Bob; BARANGU, Linda ORTECH International
2395 Speakman Drive, Mississauga, Canada, L5K 1B3; (416) 822-4111

THE ROLE OF WASTE EXCHANGE IN WASTE MINIMIZATION

This paper discusses the rationale for industry to consider waste minimization as the most cost effective approach to industrial waste management. It deals with the role of Waste Exchange in helping industry to minimize the quantities of waste for treatment and disposal. The history, performance and future plans of the Canadian and Ontario Waste Exchanges will be discussed in some detail.

HAYTON, L. H. Greater Vancouver Regional District
4330 Kingsway, Burnaby, Canada, V5H 4GB; (604) 432 6464

THE GRVD SOLID WASTE MANAGEMENT PLAN

The Greater Vancouver Regional District (GRVD) a partnership of 18 municipalities and 3 electoral areas provides services such as parks, public housing, water supply, sewage collection and treatment, and solid waste disposal. This paper will trace the development of the GRVD's solid waste management plan and how the plan has evolved to reflect changes in public attitudes towards waste management. The plan incorporates recycling programs, landfills, transfer stations, resource recovery plants and a mass burn incinerator.

HOLLIDAY, Don A-1 Products Corporation
212 - 1325 Eglinton Avenue, Mississauga, Canada, M9C 4V2; (416) 626-6444

CURBSIDE RECYCLING

Curbside recycling is an important factor in waste management, and the use of Blue boxes has become a feasible means of diverting waste from landfill sites. Several variables are essential for the success of an efficient curbside recycling program. This paper discusses the factors involved in increasing diversion rates, encouraging public support for Blue Boxes, and providing cost-effective ways of dealing with waste management.

HOULDING, Alan S.W. LYNX Geosystems Inc.
Suite 400, 1199 West Pender Street, Vancouver, Canada, V6E 2R1; (604) 682-5484

APPLIED GEOSCIENCE MODELLING FOR THE ENVIRONMENT

LYNX Geosystems Inc. has developed a computer system for 3 dimensional geoscience modelling based on the new 3D component modelling technology. This highly interactive graphics-based system has major application to environmental management and control of earth resources. Primary applications of the system include the investigation of subsurface contamination by hazardous waste materials and the determination of remedial measures; the design of surface and underground facilities for storage of waste materials; reclamation of the environment from the effects of surface and underground mining operations; and processing of information prior to dynamic studies of groundwater pollution contamination.

KENNEDY, Joseph W. WCI Waste Conversion Inc.
69 Eastern Avenue, Brampton, Canada, L6W 1X9; (416) 450 5515

URBAN WASTE WOOD RECYCLING

Urban waste wood represents about 10% of the total municipal solid waste stream currently landfilled. WCI has established a waste wood processing and manufacturing centre in Brampton with the objective of achieving 100% diversion of waste wood from the landfill. This is the first such facility in Canada. It is designed to receive and process 140 tonnes a day of all types of waste wood. Processing activities include classification, stage size reduction, magnetic separation and product screening. The paper discusses the operating experience of the processing centre and the waste wood products market being developed.

MORGENSTERN, Daniel Economic and Environmental Consultants
12 Leshem Mevaseret-Zion 90805 Israel; (972) 02341464

SOLID WASTE RECYCLING IN ISRAEL

This paper describes the problems and the successes of waste recycling in the country of Israel. The problem of solid waste disposal in Israel is much like that of countries in North America. The main waste dump in Tel Aviv is already full. Necessity demands that recycling be encouraged at all levels in the society. Israel's experience as one of the world's most intense recycling nations may have significant benefits for other nations facing this intractable problem.

PIETRASANTA, Y. Robin J.J. Ecole Nationale Superieure de Chimie de Montpellier
#8 Rue de l'Ecole Normale, 34075 Montpellier, France; (33) 67-63-52-73

THE RECYCLING OF MIXED PLASTIC MATERIAL: THE USE OF EMULSIFIERS

One of the main constituents of garbage is plastic materials. Different plastics recovered are usually made with different polymers and it is very difficult to combine these plastics into a single useable plastic product. This paper presents one method of joining plastics together through the use of emulsifying or compatible agents. The work concerns the synthesis of various emulsifying agents applicable to various polymer mixers. It describes a method of preparing these emulsifiers, the characterization of the products obtained, the mechanical performance of the different alloys, and the results of a rheological study on the resulting copolymers.

READ, Jonathan McLaren Engineers Incorporated
Atria North Phase II, 2235 Shepherd Avenue East, Willowdale, Canada, M2J 5A6; (416) 756-4919

SOLID WASTE COMPOSTING: A PRACTICAL AND ENVIRONMENTALLY SOUND FORM CF SUSTAINABLE DEVELOPMENT

Composting, the controlled biological decomposition of organic material to a relatively stable humus-like material, is practised to various extents throughout many areas of the world. While most facilities deal solely with sewage sludge, the composting of organic solid waste is being increasingly considered as a viable waste reduction alternative, particularly waste incineration. This paper discusses the principles and philosophy behind composting, as well as state-of-the-art operational methods currently being promoted to carry it out. Opportunities for private sector partnerships are outlined. Costs and environmental benefits are described.

SCOTT, P.E; BALDWIN, G; MACDONALD, Colin A. Harwell Laboratory, Waste Research Unit
Environmental Safety Centre, Didcot, England; (44) 235-821111

METHODS USED TO CHARACTERIZE AND ASSESS THE ENVIRONMENTAL IMPACT OF GASEOUS EMISSIONS FROM LANDFILLED WASTES

The United Kingdom produces in excess of 28 million tonnes of household waste per annum. Approximately 89% of this waste is disposed of to landfill. Degradation of the organic wastes produces a gas rich in CO_2 and methane. It also contains a wide range of organic compounds present at trace concentrations which may exert a deleterious impact on the environment. Over a number of years the WRU carried out a program of research investigating the gaseous emissions from household wastes. The research objectives were

1) to characterize the trace composition of landfill gas under a variety of landfill conditions;
2) to investigate the evolution of trace components with refuse age and stage of decomposition; and
3) to assess the environmental impact of the trace components in landfill gas.

This paper outlines the methods employed in order to meet these objectives.

WIRTZ, Alexander Alcan Deutschland GmbH
P.O. Box 5149, D-6236 Eschborn, Federal Republic of Germany; (49) 6196 407-152

ALUMINIUM BEVERAGE CANS: THE ENERGY-SAVING PACKAGING SYSTEM

The aluminium beverage can is sometimes - deliberately or by false comparisons - unfairly accused of being energy intensive. Any objective audit of the various packaging materials and packages must compare the primary energy consumed to package a given volume of liquid rather than compare energy used per tonne of material produced. In 1988 an aluminium industry appraisal of a scientific study by Prof. Schafer and Dr. Hartmann: Munich/Germany showed that on this basis there is no significant difference in the energy required to produce and fill 33 cl. aluminium cans, tin plate cans or one-way glass bottles. When the benefits from recycling are included the aluminium can becomes progressively more energy efficient than tin plate cans or one-way glass bottles. The paper outlines the necessary evaluation criteria and highlights the technological achievements of aluminium can sheet production and recycling results which makes the aluminium beverage can an ecologically friendly and the most energy efficient package for beverages.

ZIMMER, J. Wayne SARCAN
140 Avenue F North, Saskatoon, Canada, S7L 1V8; (306) 933-0616

SARCAN: A SASKATCHEWAN RECYCLING PROGRAM

SARCAN, a province-wide recycling program operated by the Saskatchewan Association of Rehabilitation Centres (SARC) delivers an innovative system of material collection for aluminum, P.E.T., and glass through a program which creates permanent jobs for special needs disabled persons. As a multi-material collection system, SARCAN provides a dynamic, practical, popular alternative to the "blue box" system without the associated costs. Supported by a nominal surcharge, the program creates "real work for real pay" and generates revenue for further environmental activities while effectively dealing with litter.

STREAM F2
SUSTAINABLE DEVELOPMENT POLICIES

BAJARD, Yves First Watercount Systems Limited
595 West 24th Avenue, Vancouver, Canada, V5Z 2B5; (604) 876-2440

THE CHALLENGE OF THE NEXT FEW DECADES: SUSTAINABLE DEVELOPMENT DISCOURSE VERSUS REALITIES

When Globe 90 takes place, nearly three years will have elapsed since the World Commission published its report Our Common Future. The paper proposed here examines what has taken place during these three years, in terms of action toward implementing the recommendations of the World Commission, and for Canada, those of the National Task Force on Environment and Economy. This reflects the result of a logical analysis of the author's experience and readings on the subject, which has been the focus of his professional activities for more than 20 years.

BOYANOWSKY, Ehor O. Psychology & Law Institute of Criminology, Simon Fraser University
Burnaby, Canada, V5A 1S6; (604) 291-4205

TOWARDS THE CRIMINOLOGY OF THE ENVIRONMENT: A GUIDELINE FOR CONDUCTING BUSINESS IN THE 21ST CENTURY

Although a great deal has been written about environmental law, very little research has focused on the behaviour of the law, public perceptions of the relative gravity of crimes against the environment, the deterrent effects of various penalties, and the various means of enforcement. This paper will discuss these concepts and emerging research results that will allow businesses to plan future enterprises in a manner that is not offensive to the environment, the public or the law.

CHAPMAN, Peter M. E.V.S. Consultants
195 Pemberton Avenue, N. Vancouver, Canada, V7P 2R4; (604) 986-4331

THE ENVIRONMENTAL QUALITY TRIAD

The Environmental Quality Triad comprises 3 separate but complimentary components: laboratory measurements to determine effects independent of external compounding variables; analytical measurements to determine the presence of potential causative agents; and, field measurements to determine what effects are manifest in the natural environment. Basically, the triad combines potential cause (e.g. chemical) measures with measures of effects (e.g. biological) to provide both proactive and reactive information on environmental quality. Examples are used and emphasis is made of the utility of the triad to Asia.

DALON, Richard L. Ministry of the Environment, Province of B.C.
810 Blanchard Street, Victoria, Canada, V8V 1X5; (604) 387-9879

A POLICY FOR SUSTAINABILITY

The Government of British Columbia is making a fundamental shift towards comprehensive integration of economic development and environmental management. Recent initiatives include:

1) establishment of a cross-sectoral round table to advise cabinet on environmental concerns
2) the merging of Regional Development and Environment and Land Use Committees to ensure environmentally sound development
3) development of a solid waste management strategy
4) strengthening of the province's enforcement capability with tough anti-pollution regulations and sharply increased fines for offenders.

DAUVERGNE, John Industry Science and Technology Canada, Government of Canada
10th Floor E., 235 Queens Street, Ottawa, Canada, K1A 0H5; (613) 954-2951

ENVIRONMENTAL INDUSTRY DEVELOPMENT: ONE PATHWAY TO SUSTAINABLE DEVELOPMENT

While support for sustainable development is widespread, the concept still needs to be translated into practical initiatives. This paper argues that one key way of giving practical meaning to sustainable development is to develop an internationally competitive, world-class environmental industry. It examines 8 types of industry development initiatives that can help achieve this goal. The paper concludes with the observation that local government, by privatizing and commercializing the operation of municipal environmental infrastructure, can also do a great deal to help develop a more competitive environmental industry.

DOYLE, Derek Manitoba Natural Resources, Province of Manitoba
603 - 191 Broadway Avenue, Winnipeg, Canada, R3C 4B2; (204) 945-6826

THE CHALLENGES FACING RESOURCE MANAGERS IN 2000

This paper looks at the concept of sustainable development from 3 vantage points. The first relates to the lessons of history dating back to Babylon. The second part of the paper addresses some of the major forces that are changing the world of resource managers. The paper concludes by setting forth several strategies for resource managers into the next century. This paper is applicable not only to private business managers but also to government resource managers.

FOWLE, Francis V. Francis V. Fowle & Associates
Silbury Business Centre, Silbury Court, 356 Silbury Boulevard, Central Milton Keynes, England, MK9 2LR; (44) 908-604848

THE ENVIRONMENTAL ENGINEERING SPECIALIST: A NEW PROFESSION OR UNBRANDED CALF

Environmental Legislation and the swell of world opinion is placing major investment decisions on industry, ranging from market opportunities to the serious modification or wholesale abandonment of manufacturing facilities, to the conflict over existing trade embargoes. Clearly, choices must be made not only on the traditional motives of profit, market share and pay back but also on the escalating costs of being environmentally acceptable in operation. Adapt or die is the investment decision of the decade. This paper deals with the changing attitudes that are required for sustainable development and describes a multidisciplined approach from the perspective of various professional groups including engineers, lawyers, and scientists.

GAUTHIER, Jean Pierre Conservation Protection, Environment Canada, Government of Canada
1141 Rue de l'Eglise, Saint Foy, Canada, G1V 4H5; (418) 648-4619

ST. LAWRENCE ACTION PLAN

The St. Lawrence Action Plan, announced on June 3, 1988, is an integrated intervention clean-up and protection plan for the St. Lawrence River. Environment Canada will spend $110 million over five years to protect, conserve and restore the St. Lawrence River. The paper will deal with the formal commitment made by the Federal Government, the four components of this integrated program, the importance of the technological development as a tool to help reduce toxics, the partnership between all of the parties involved, and the harmonization of Federal and Provincial Governments in this environmental challenge.

HAGEN, Honourable Stanley B. Regional and Economic Development, Government of B.C
Parliament Buildings, Victoria, Canada, V8V 1X4, (604) 387-1241

ECONOMIC POLICY AND SUSTAINABLE DEVELOPMENT IN BRITISH COLUMBIA

This paper details the policy initiatives that the Government of British Columbia and the Ministry of Regional and Economic Development have made to implement sustainable development principles. New approaches to economic development planning and specific government actions to promote sustainable development are described. One of these initiatives is new partnerships between opposing interests both within and without the government. This and other actions will allow the government to institutionalize patterns for dealing with environment and development issues.

HAWKINS, David MacDonald Dettwiler and Associates
13800 Commerce Parkway, Richmond, Canada, V6V 2J3; (604) 278-3411

RESOURCE MANAGEMENT INFRASTRUCTURES: BEYOND RESOURCE INFORMATION MANAGEMENT SYSTEMS AND REMOTE SENSING SYSTEMS

Since the launch of the first Landsat Series Satellites, remote sensing has been touted as a major resource management tool. Although many of the technical problems which have limited the applications to real problems have been solved, it is still very difficult to use remotely sensed data for "operational" resource management. This paper discusses the management process from the point of view of the resource managers and identifies effective methods for getting remotely sensed data out of the labs and into the hands of the people who can use it as a basis for decision making.

KENT, Michael J. Ministry of Transportation and Highways, Province of British Columbia
940 Blanchard Street, Victoria, Canada, V8W 3E6; (604) 387-7768

MITIGATION STRATEGIES: THE KEY LINKAGE FOR MAJOR LINEAR PROJECTS IN SUSTAINABLE DEVELOPMENT

Environmental impact assessment of major linear projects has often focused on avoidance or post-construction compensation. In order to satisfy the demands of sustainable development, environmental mitigation strategies will have to be incorporated into the engineering designs of major highway projects. This will ensure that remedial and enhancement works are built within the project, not as a post-construction compensation. This paper will present a number of examples of successful environmental mitigation proposals whereby costs and resulting productivity have met the sustainable development concept.

KLASSEN, W.J. Government of the Yukon
Box 2703, Whitehorse, Canada, Y1A 2O6, (403) 667-5460

A NORTHERN APPROACH TO SUSTAINABLE DEVELOPMENT

In planning for future growth the Yukon launched a two year public consultation process to determine a consensus on the future economic direction of the Yukon. There have been two results of this consultation process. The first is the Yukon economic strategy which identifies sustainable development and approaches the concept from an economic point of view - but recognizing the environment, resources and cultures. The second result was a conservation strategy which will be used to guide the sustainable development of renewable resources and the environmentally sound development of non-renewable resources. This presentation details both strategies.

KNELMAN, Fred H. Whistler Foundation for a Sustainable Environment
#700 - 845 Cambie Street, Vancouver, Canada, V6B 4Z9; (604) 873-6943

ENERGY AND THE SUSTAINABLE SOCIETY

The Bruntland report correctly sights energy centre stage in the issue of sustainability. This paper deals with the broad question of energy policy, as it pertains to the achievement of sustainable societies. The author correlates energy systems with economic and political development as well as values, culture and environmental impact.

MACLEAN, Ronald A.N; SAVOIE, M. Arthur D. Little Limited
Science Park, Milton Road, Cambridge, England, CB4 4OC; (44) 223-422-0024

ENVIRONMENTAL MANAGEMENT SYSTEM FOR THE CHEMICAL INDUSTRY

This paper argues in favour of an environmental management system, which reduces the risk of environmental liabilities and reaps other hidden benefits in improved efficiency and productivity which arrives from better awareness of their operations. The paper looks at ten specific steps that can be used in achieving this goal. The chemical industry will be used as the case in point.

MAYNARD, Allan W. Analytical Service Laboratories Limited
1650 Pandora Street, Vancouver, Canada, V5L 1L6; (604) 253-4188

THE ENVIRONMENTAL LABORATORY: MEETING THE CHALLENGE OF THE 90's

Over the past ten to fifteen years, laboratory capabilities, costs, complexities and work loads have increased dramatically. In addition, increasingly stringent and detailed regulatory requirements are being imposed for laboratory certification programs and documentation of quality assurance programs and results. This paper discusses the challenges that face a modern chemical analytical laboratory, including capital acquisition, technical development, personnel requirements, management functions, data handling and client liaison. The paper also discusses the transfer of this technology to developing nations.

MOORE, Curtis The Technology Clearing House
P.O. Box 6091, 6019 Woodley Road, McLean, U.S.A.; (703) 536-2414

CONTROLLING POLLUTION THROUGH NEW TECHNOLOGIES AND FUEL USE

This presentation outlines several paths that can be used towards zero air pollution. The author contends that the environmental technology is available to reduce emissions to zero from industry, home, and transportation sectors. The specific steps required are outlined and examples of the technology are provided.

WENMAN, Paul ERL (Asia) Limited
11th floor Hecny Tower, 9 Chatham Road, Tsimshatsui, Kowloon, Hong Kong; (85) 2-7220292

COPING WITH UNCERTAINTY IN ENVIRONMENTAL POLICY DEVELOPMENT

Long term strategies for environmental protection need to be designed with an awareness of their cost-benefit robustness to change and uncertainty. What is the risk of a strategy failing to meet objectives because economic growth in one sector or another is different from that expected, or because our current understanding of the linkage between industrial and agricultural activities and environmental damage proves to be incorrect to one degree or another? Economic and scientific uncertainties should be considered so that the costs of insuring our policies against failure can be assessed.

WHITBY, Leslie, M.A. Sustainable Development and State of the Environment, Environment Canada Reporting Branch, Place Vincent Massey, Hull, Canada, K1A 0H3; (819) 997-1246

"HOW ARE WE DOING" - THE ROLE OF ENVIRONMENTAL INDICATORS

While most Canadians can generally answer the question "How are we doing?" with respect to their economic health or social well being, it is extremely difficult to answer the question with respect to the environment. More and more, Canadians are asking for practical information in order to make decisions that can influence environmental quality. Indicators are aggregates of information that will allow Canadians to make better decisions about their environment. Canadian institutions are undertaking major efforts in indicator development and within the next 18 months Canadians will have simple, readily understandable indicators to allow them to assess their performance.

YIN, Yongyuan Department of Geography, Simon Fraser University Burnaby, Canada, V5A 1S6; (604) 291-4558

INCORPORATING MULTIVARIATE INFERENCE WITH FUZZY MODELLING IN A STUDY OF THE SPACTIAL PATTERNS OF AIR POLLUTION SYSTEMS

The purpose of this paper is to explain the development of a research framework for air quality assessment using two distinct analytical techniques: multivariate inference and fuzzy set modelling. These two are then linked together to form an integrated research framework which acts as a flexible and effective decision support system. An emphirical evaluation is conducted for the City of New Westminister, Canada, to demonstrate the capability and effectiveness of the methods for environmental systems analysis. The study also identified quantitatively the spatial influence air quality.

STREAM F3
SUSTAINABLE DEVELOPMENT PRACTICES

ABS, Susan L.
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"ACT LOCALLY": PROTECTING ENVIRONMENTALLY SENSITIVE AREAS IN URBAN SETTINGS

Many municipalities are joining in the search for practical ways to integrate environmental protection and economic development in their communities. This paper describes the trend towards increased municipal involvement in environmental protection and particularly the designation of "environmentally sensitive areas" (E.S.A.'s). An E.S.A. is a significant landscape which forms part of the natural and cultural heritage of the municipality, and which requires management to protect it from adverse human impacts. E.S.A.'s can include important physical, biological, archaeological or historical features, or a combination of these. A case study of Surrey, B.C. is used to illustrate the issues.

BOTT, B.J; LEBOE, B.M. Life Systems Development Corporation
908-510 West Hastings Street, Vancouver, Canada, V6B 1L8; (604) 683-6880

NEW PRODUCTS FOR FISH WASTE MANAGEMENT

Life Systems Development Corporation has established a group of companies which produce value-added products from fish waste. Life Systems has developed a superior technology for tanning fish skins into high quality exotic leather which is known under the trademark name of "Cuir Marin". The company has also developed a new, low cost fermentation technology for processing the rest of the waste from fish processing (OFFAL) into high quality fish meal, feed and food products. Studies are also being conducted on the use of fermented fish meal and processed foods for human consumption. This paper discusses the techniques and processes used in manufacturing these various products.

DORCEY, Anthony H.J. University of British Columbia, Wastewater Research Centre
2075 Westbrook Mall, Vancouver, Canada, V6T 1W5; (604) 228-4956

POLICY AND LEGISLATION FOR SUSTAINABLE DEVELOPMENT OF RIVER BASINS

One of the greatest challenges of sustainable development is the creation of a policy in legislative framework that provides for the efficient integration of a multitude of decisions. The paper focuses on these issues as they relate to the sustainable development of water resources in large river basins, and draws on experience in the Fraser River Basin in British Columbia to suggest the new types of policy and legislative framework that will be required.

DUNCAN, William F.A; NEIL, Elizabeth M. William Duncan and Associates
4395 Valencia Avenue North, Vancouver, Canada, V7N 4B2; (604) 988-7186

A FRAMEWORK TO IMPROVE AQUATIC ENVIRONMENTAL IMPACT ASSESSMENT: A NORTHERN CANADIAN CASE STUDY

This paper introduces and applies a conceptual framework which address the causal relationships linking contaminant doses with responses in aquatic environments. The paper is focused on metal contaminants and presents a northern case study in which the framework was applied. The approach emphasizes the environmental factors regulating the potential effects of contaminants, and stresses the importance of understanding the physical environmental processes in monitoring design and selection of linkages between the contaminant dose and the valued ecosystem components.

DUTANG, M. Compagnie Generale des Eaux,
52 Rue D'Anjou, 75384 Paris Cedex 08, France; (33) 42-66-91-50

INTEGRATION OF POLLUTION TREATMENT TECHNOLOGIES FOR URBAN AREAS

This paper addresses recent progress in the area of pollution treatment technologies for urban areas and includes discussions of water treatment plants, purification stations, and household waste incinerator plants. A purification station constructed at Monaco is used as one concrete illustration of this concept.

HYSLOP, W.F. NovaTec Consultants Inc
300-40 Powell Street, Vancouver, Canada, V6A 1E7; (604) 682-8777

BIOLOGICAL NUTRIENT REMOVAL, AN EXPORT OPPORTUNITY

Severe restrictions on the permissible levels of nutrients being discharged has created a market for innovative technology. Earlier methods have all involved the "addition to" existing processes either in the form of chemicals or in additional process steps. Consistent effluent phosphorous levels below 0.3mg/L are now attainable without chemical addition. Nitrogen levels at or below any attained at large scale, "conventional" plants can be reached within the one process train. An outline of the process, including special elements of the design is presented, as are cost comparisons. Case histories of successful export of the technology are also presented.

INGRAM, Gordon Brent University of British Columbia, Department of Plant Sciences
Room 334, 2357 Main Mall, Vancouver, Canada; (604) 228-5271

RAINFOREST AND MARINE HABITANT CONSERVATION INITIATED BY INDIGENOUS PEOPLES

In remote areas with indigenous communities and subsistence economies, land use planning has rarely involved socially viable approaches to protection of natural habitat. Efforts to conserve rain forest and island habitat have nearly always involved imposition of the priorities for economic development and cultural perspectives of dominant metropolitan groups. In a number of parts of the world indigenous communities are restructuring the frameworks for land use planning imposed on them. Using three island settings as examples this paper discusses the political strategies used by local people in pursuing their own priorities for habitat conservation.

KALINNIKOV, Vladimir; MASLOBOEV, V.A. Kola Science Centre
#14 Fersnan Street, Apatity, U.S.S.R., 184200; (7) 31445

ECOLOGICAL ASPECTS OF MINERAL RESOURCES COMPLEX UTILIZATION IN THE NEAR ARCTIC ZONE

The Kola peninsula, in the Mermansk region of the U.S.S.R. is a resource extraction area and suffers from the usual pollution problems of many other parts of the world. In particular, mining and processing of minerals creates air, water and soil pollution which is undermining the ecological balance in this region. This presentation details one method of minimizing the pollution by utilizing the waste material for the production of primary manufacturing goods. This unique proposal requires the collective efforts of not only the U.S.S.R. but Finland as well. To deal with this problem the Institute of Industrial Ecology of the North was set up in 1989 within the framework of the Kola Scientific Centre.

KWAN, Richard K.Y. Environment Protection Department, Hong Kong Government
28th Floor, Southorn Centre, 130 Hennessy Road, Hong Kong, (852) 5-835-1127

CHALLENGES AND SOLUTIONS IN NOISE CONTROL: THE HONG KONG SCENARIO

From its humble beginning of a cluster of fishing villages with only 2,000 inhabitants a century ago, Hong Kong has grown by leaps and bounds into a thriving industrial and commercial metropolis on the Pacific Rim, claiming titles such as the world's busiest container port and the eleventh largest exporter. Commensurate with this growing industrialization has been an extraordinary increase in environmental noise of all types. This paper will discuss some unique noise pollution problems facing Hong Kong, the policy initiatives and legislative framework adopted to tackle this widespread everyday concern, and the practical solutions being employed for mitigation and prevention purposes.

LANE, M.H. Paramedica
P.O. Box 447, 4 Chedworth Road, Scarsdale, U.S.A. 10583; (914) 472-2488

ASBESTOS - A MULTI-DISCIPLINARY APPROACH

The greatest constraint to the growth in the Environmental Consulting field, generally, is the very limited availability of certain experienced professionals. This has a particular relevance in the area of asbestos. The prevalence of asbestos in the work environment requires the coordinated and professional approach to assessing the dangers and defining the solutions. PARAMEDICA has brought together a team of highly qualified individuals to perform these tasks. These professionals will be briefly discussed in the light of their complementary skills and the manner in which they interface to effectively assess problems and design optimum solutions.

LINDROOS, V.K. Mexpert Environmental Technology Ltd.
Otaniemi Science Park, 02150 Espoo, Finland, 02150; (358) 0-437-5455

NEW FINNISH HANDBOOK OF ADVANCED ENVIRONMENTAL TECHNOLOGY

The experiences of Finland and many other countries verify that the most efficient way of protecting the environment is to prevent the generation of pollutants at their source, instead of repairing damages already occurred. The preventative and sustainable management of ecological resources needs a firm technological base. This kind of technology - sparing raw materials, energy and the environment - is better known as low and non-waste technology (LNWT). Following the principles of non-waste technology and the exploitation of natural resources, the preconditions for sustainable economic, technological and social development in the future will develop. This paper describes the handbook which was designed to describe the background, content and the state-of-art of LNWT both from the international and national perspectives.

LUSH, D.L; WICKWARE, G.M. Beak Consultants Limited
14 Abacus Road, Brampton, Canada, L6T 5B7; (416) 458-4044

THE PRACTICAL APPLICATION OF GEOGRAPHIC INFORMATION SYSTEM (G.I.S.) TECHNOLOGY FOR THE ASSESSMENT OF ENVIRONMENTAL EFFECTS AT A PROPOSED REMOTE MINING DEVELOPMENT

Urangesellschaft Canada Ltd. has proposed to develop a controversial open-pit uranium mine in the eastern Keewatin district of northern Canada. The proposed development is currently under review by the Canadian Federal Environmental Assessment Review Office. A portion of the terms of reference for the project call for an environmental assessment of the proposed development on the land and waters in the project area. The G.I.S. system was used for detailed biophysical mapping, and determining potential air and water emissions from sites. This paper discusses the methods used and the results of the G.I.S. analysis.

MCPHEE, M. Fraser River Estuary Management Program
708 Clarkeson Street, New Westminster, Canada, V3M 1E2; (604) 525-1047

INTEGRATING ENVIRONMENT AND ECONOMY IN THE FRASER RIVER ESTUARY: THE FRASER RIVER ESTUARY MANAGEMENT PROGRAM

The Fraser River Estuary plays a vital role in sustaining fisheries and wildlife values of regional and international importance. The port and related economic activity contributes in excess of $5 billion annually to the provincial economy. Located on the doorstep of 1.5 million people, the Estuary is used extensively for recreation. Management of the Estuary's resources is complex with over 60 agencies involved. The Fraser River Estuary Management plan is an innovative and successful program for integrating environment and economy in the management of the Fraser River Estuary. This paper discusses FREMPs program in practical activities designed to achieve environment and economic integration and to assist in anticipatory environmental planning and the prevention of environmental damage.

OSMOND, D; FRASER, D. Gartner Lee Limited
#490-6400 Roberts Street, Burnaby, Canada, V5G 4C9; (604) 299-4144

URBAN DEVELOPMENT AND WETLAND PROTECTION: A CASE HISTORY FROM ONTARIO

As an explanation of Ontario's Wetland Policy, this paper describes a case history in which plans for a large condominium project were developed through the integration of a significant wetland that extends along the near shorelands of the Collingwood area on Georgian Bay.

PHIPPS, T.W; DAY, J.Chad Simon Fraser University, Natural Resource Management Program
Burnaby, Canada, V5A 1S6; (604) 291-4659

COAL DEVELOPMENT IN BRITISH COLUMBIA: REGULATING BIOPHYSICAL CONCERNS FOR SUSTAINABLE DEVELOPMENT

This study evaluates the effectiveness of B.C.'s Coal Guidelines Review Process (CGRP) as a comprehensive system of impact assessment and information exchange to promote ecologically sustainable development. It begins by comparing two Elk Valley surface coal developments by Kaiser Resources Ltd., the Harmer Ridge Mine and the Green Hills Mine. Improvements and remaining deficiencies are identified in responding to socio-economic changes induced by coal development. Finally, the review concludes with an evaluation of changes resulting from the mine development review process (MDRP), which replaced CGRP in 1984.

REEVE, Noelle W. Forum for Planning Action
4414 M.P.O., Vancouver, Canada, V6B 3Z8; (604) 733-8478

SUSTAINABLE DEVELOPMENT IN MUNICIPALITIES: MAKING IT WORK

This paper begins by setting the concept of sustainable development in a context of planning initiatives familiar to urban planners. The paper then relates sustainable development principles to the responsibilities to municipal governments. Examples of S.D. initiatives by urban governments in Europe, Canada and British Columbia are provided. These examples are used to develop a model planning process for sustainable communities. Appropriate municipal actions in waste management, air and water quality, transportation and land use planning are suggested.

STUART, David; ROBERTS, Richard Praxis
2215 19 Avenue South West, Calgary, Canada, T2T 4X1; (403) 245-6404

IMPROVING EXISTING OPERATIONS THROUGH IMPACT ASSESSMENT

Increasing economic disinterest in large scale energy projects over the past five years has shifted the socioeconomic and environmental impact assessment focus to the operations activities of resource companies. This is occurring due to increased public attention being placed on environmental concerns which are showing up in existing operations and in the decommissioning of older plant infrastructures across North America. Petro Canada is addressing this issue by identifying key environmental and socioeconomic issues that are of concern not only to local residents, but to the local, regional and provincial governments and agencies as well. This paper discusses the findings of these current assessments and some of the overall patterns which are becoming apparent as more are completed.

STREAM F4

HAZARDOUS AND TOXIC MATERIALS

ANDERSON, E. Grant; LEE, Ken B. Gartner Lee Limited
#409 - 6400 Roberts Street, Burnaby, Canada, V5G 4C9; (604) 299-4144

PREPARING AN ECONOMICALLY VIABLE, PUBLICLY ACCEPTABLE AND ENVIRONMENTALLY SAFE DOMESTIC WASTE MANAGEMENT PLAN

This paper describes solid waste disposal alternatives and establishes a framework for siting. The framework integrates 3 main siting components:
1) environment (social, natural and economic);
2) technology;
3) government regulations.
The waste management planning process requires public input at every decision point and involves a careful assessment of trade offs. Case studies are presented.

BROWN, Richard A. Groundwater Technology Incorporated
100 Youngs Road, Mercerville, U.S.A. 08619; (609) 587-0300

IN SITU BIORECLAMATION OF A GASOLINE SPILL IN A LOW PERMEABLE HETEROGENEOUS FORMATION

In situ bioreclamation is a technique of using naturally adapted indigenous microorganisms to degrade organic contaminants. The principal of operation is that when sufficient oxygen, nitrogen and phosphorus are supplied to a contaminated site the indigenous microorganisms multiply and rapidly degrade the organic contaminants. This operation entails 3 technical aspects, microbiology, chemistry and hydrogeology. The site discussed is a fractured bedrock overlaid with fill and contaminated from gasoline leaks. This site represents the first successful application of in situ bioreclamation in Canada.

DANKO, Joseph P. CH2M Hill Engineering Ltd
2300 North West Walnut Boulevard, P.O. Box 428, Corvallis, U.S.A. 97339; (503) 752-4271

REMEDIATION AT A U.S. SUPERFUND SITE CONTAMINATED WITH VOLATILE ORGANIC COMPOUND

The Verona Well Field in Battle Creek, Michigan, USA, supplies potable water to approximately 50,000 people and a significant industrial base. In 1981, the well field and surrounding area were found to be contaminated with chlorinated solvents. The US EPA corrective action included converting potable wells into blocking wells to prevent further migration of contaminants, installing an air stripping system to treat contaminated groundwater, and installing new potable water wells to supplement the city's water supply. A solvent distribution facility was identified as the major source of contamination. The EPA chose groundwater extraction with treatment in combination with soil vapour extraction to clean up contaminated groundwater and soil at this source. The potable water supply system has been protected, and nearly 60,000 pounds of VOCs have been removed from the source area.

DAVIS, Dan Radian Corporation
8501 Mo-Pac Boulevard, P.O. Box 201088, Austin, U.S.A. 78720-1088; (512) 454-4797

CEMENT KILNS FOR HAZARDOUS WASTE TREATMENT: OPPORTUNITIES & CONSTRAINTS FOR THE PACIFIC RIM

The cement kiln is an extremely effective treatment device for selected hazardous wastes, and is becoming common practice in Europe and North America. This paper focuses on the opportunities associated with the use of cement kilns for waste disposal in the Pacific Rim. The types of waste that are suitable for treatment in a cement kiln will be discussed as will the treatment effectiveness of the kiln. The paper will also illustrate the economic benefits enjoyed by the cement manufacturer and the waste generator. The process required to implement a waste treatment program at a cement production facility will be presented. special challenges that developing countries may face as they attempt to implement such a program will be explored.

GRAY, Robert H. Battelle Memorial Institute, Pacific Northwest Laboratory
P.O. Box 999, Battelle Boulevard, Richland, U.S.A. 99352; (509) 375 2937

ENVIRONMENTAL SURVEILLANCE AT THE HANFORD SITE, SOUTHEASTERN WASHINGTON, USA: A HISTORY OF SUCCESS

Environmental surveillance has been an ongoing activity at the U.S. Department of Energy's Hanford Site for 45 years. Objectives are to detect and assess potential impacts of facility operations on air, surface and ground water, foodstuffs, fish, wildlife, soil and vegetation. Data from monitoring efforts are used to calculate the overall radiological dose to humans working on site or residing in nearby communities. The radiological dose received by a hypothetical individual using worst-case assumptions for all routes of exposure in 1988 was below applicable regulatory limits. In addition, the Site serves as a refuge for a variety of plants and animals.

HAWKE, Tony Groundwater Technology Inc.
8435 Notre Dame Street East, Montreal, Canada, H1L 3L3; (514) 353-6939

A SOLUTION TO HYDROCARBON SEEPAGE INTO THE ST. LAWRENCE RIVER

Groundwater Technology Inc. undertook a project to abate the seepage of petroleum hydrocarbons into the St. Lawrence River along a 340 foot section of the Port of Montreal. The company utilized construction techniques, hydrogeology and geosynthetic materials to realize a solution to the seepage. Seepage into the river was effectively stopped and 7000 litres of hydrocarbons were recovered. This paper features the design, field techniques and the clean-up process that was undertaken.

HUGGINS, Andrew; LUDVIGSEN, Phill The Environmental Resources Management Group
855 Springdale Drive, Exton, U.S.A. 19341; (215) 524-3576

COMPUTER ASSISTED RISK ASSESSMENT TOOLS FOR HAZARDOUS WASTE SITE MANAGEMENT

Computer assisted risk assessment tools add consistency to risk estimation and risk management decisions, in this case as they relate to the study and remediation of hazardous waste sites. The tools incorporate exposure modelling and assessment with toxicity indices to derive estimates of risk. The process can be reversed to establish soil clean-up levels. The paper reviews and assesses available tools and examines their applications in various settings through the presentation of case studies.

LEACH, J.M; McKINLEY, J.W. B.C. Research Corporation
3650 Wesbrook Mall, Vancouver, Canada, V6S 2L2; (604) 224-4331

DESIGN AND OPERATION OF A HAZARDOUS MATERIALS ANALYTICAL LABORATORY

Prior to engaging an analysis of chlorinated dioxins and furans, B.C. Research undertook conversion of existing laboratory space into a self-contained clean room/high hazard laboratory. Factors in the design, construction and operation of this modern facility will be described in relation to sample integrity and analytical accuracy, and personnel and environmental protection.

LESLIE-BOLE, Cynthia Environmental Resources Management - West
260-1777 Bothelo Drive, Walnut Creek, U.S.A. 94596; (415) 946-0455

RISK COMMUNICATION FOR ENVIRONMENTAL PROFESSIONALS

This paper focuses on the fundamentals of risk communication. It outlines the dynamics of risk perception, and provides guidelines for effective communication with the public and the media on environmental issues. The goal of the paper is to enable readers to move beyond the "old school" approach of unilateral decision making, disclosure avoidance and one-way communication into a proactive, collaborative one that benefits all involved parties. The result of this more progressive risk communication approach will ultimately be sounder, more implementable solutions, more informed media and community representatives, and industry leaders who are more cognizant and responsive to the concerns of the communities upon which they depend.

MACEK, J; ZAKRAJSEK, S; DOLENC, F. Edvard Kardelj University
Department of Chemistry and Chemical Technology, Murnikova 6, P.O. Box 537, 61000 Ljubljana, Yugoslavia; (38) 61-214-444

WASTE SULPHURIC ACID TREATMENT, NEUTRALIZATION, SCALE FORMATION AND ITS PREVENTION

This paper deals with the treatment of waste sulphuric acid and the elimination of gypsum scale formation on equipment. On the basis of the known theoretical correlations and the results obtained with the experiments, a statistical model has been determined for batch and continuous processes. This model correlates the super saturation of gypsum, temperature of the reaction, elapsed time (batch exp.) and residence time as well as scale formation. Further experiments were carried out on a pilot plant scale and suggestions were made from modifications in industrial neutralizations.

MADRAS, M. Gowling, Strathy & Henderson
Suite 2400, 2 First Canadian Place, Toronto, Canada, M5X 1A4; (416) 861-0148

TRANSPORTATION OF DANGEROUS GOODS - CANADIAN SYSTEM DESIGN

The transportation of dangerous goods is a necessary risk in a modern economy. The challenge is to design a system which takes into account the need to move such commodities and assures appropriate environmental safeguards. This presentation addresses the attributes of Canada's current system in order to identify the critical points at which regulation occurs. Such an analysis will provide those responsible for technical input an understanding of the context of the provision of data and thereby facilitate systems design in accordance with real risk assessment.

MOLES, F.D; MATTHEWS, E.H; JENKINS, B.G; MULLINGER, P.J.
Fuel & Combustion Technology Limited
Brow Works, Copyground Lane, High Wycombe, England, HP12 3HE; (44) 494-450-539

THE DESTRUCTION OF HAZARDOUS WASTES IN A MOBILE INCINERATOR

To ensure the complete destruction of hazardous wastes such as PCB's, it is necessary to heat them to 1100 degrees centigrade for 2 seconds in the presence of excess oxygen. This paper describes a mobile incinerator designed to completely oxidize PCB's and other wastes at this high temperature. This is achieved by careful attention to the aerodynamics of the combustion chamber and the liquid droplet trajectories therein. Some 20 years of research went into the development of this vortex combustor. The unit can be built in a wide range of sizes to burn as little as a few kilograms an hour of waste up to several tonnes per hour. Hazardous waste can therefore be safely disposed of at the source.

MYERS, Julian; BARNHART, M.J. Waste Stream Technology Inc.
661 Wyoming Avenue, Buffalo, U.S.A. 14215; (716) 838-1044

PILOT BIOREMEDIATION OF PETROLEUM CONTAMINATED SOIL

Bioremediation of various petroleum hydrocarbons occurred during a 4 month period at a site in Port Stanley, Ontario. The purpose of the project was to demonstrate that
1) all emissions from the site could be controlled to acceptable levels;
2) the PAH concentrations could be reduced to acceptable levels;
3) the project could be undertaken in a reasonable time frame and
4) it could be undertaken in a cost effective manner.
The results showed significant reductions in BTX compounds, oil and grease and polycyclic aromatic hydrocarbons.

NELSON, David; CARPENTER, D; CIRILLO, R. EnviroSearch Inc.
608 East Willmington Avenue, Salt Lake City, U.S.A. 84106; (801) 466-1035

PRESENT AND FUTURE DIRECTIONS ON HAZARDOUS WASTE MANAGEMENT IN SOUTHEAST ASIA

Commensurate with rapid industrialization in Southeast Asia is the growth in production and use of potentially hazardous and toxic chemicals. The Pacific Basin Consortium for Hazardous Waste Research was founded to address this issue. The paper examines PBCHWR and looks at specific problem areas and potential solutions.

PORTELLI, Ronald V; ALP, E; CATON, R.B. Concord Scientific Corporation
#101-1409 West Pender Street, Vancouver, Canada, V6G 2T1; (604) 685-8636

RISK ANALYSIS OF RAIL TRANSPORTATION OF DANGEROUS CHEMICALS IN AN URBAN ENVIRONMENT

A quantitative risk assessment was conducted on the transportation of dangerous chemicals by rail through the Toronto region. The analysis included identifying hazardous events and estimating probability of occurrence and consequences for each event. An advanced model was used to quantify both individual and societal risks. The result provided an estimate of public risk for the existing system, which could be compared with other societal risks for acceptability. It also provided estimates of the risk reductions which could be achieved by alternate routes and technology. Risk reductions and costs were compared for alternatives and a benefit cost assessment provided.

SINGH, Naresh C. Caribbean Environmental Health Institute
Box 1111, Castries, St. Lucia; (809) 452-3301

THE EFFECTS OF PESTICIDE USE ON PUBLIC HEALTH IN THE CARIBBEAN

Agriculture is one of the main pillars of the rather fragile economies of the English speaking Caribbean countries. Most tropical conditions which are conducive to pest and vector proliferation in agriculture and public health respectively, contribute to more rapid physico - chemical dissipation of pesticidal compounds compared to dissipation rates under milder temperature conditions. Small size leading to physical proximity of the coastal and marine environment, freshwater systems and the community at large combine to produce unique challenges and opportunities for collaboration between business and government in pesticide formulation and application technology on one hand and pesticide regulation on the other.

YAZDANI, AZITA Source Reduction Research Partnership
1052 West 6th Street, Suite 432, Los Angeles, U.S.A., 90017; (213) 482-0723

SOURCE REDUCTION OF CHLORINATED SOLVENTS: A STUDY RESULT

The Source Reduction Research Partnership (SRRP) is a unique joint venture of the Metropolitan Water District of Southern California and the Environmental Defence Fund. The Partnership is sponsoring a study to estimate the potential for source reduction of chlorinated solvents, contaminants commonly found in ground and surface water systems across the United States. This paper presents the results of the study in the solvent cleaning industry, which constitutes about one-third of the total chlorinated solvent use. Cost analyses results for a few selective case studies will also be presented.

STREAM F5
WATER/WASTEWATER

BATHIJA, Prakash R. Mixing Systems Incorporated
P.O. Box 59929, Dayton, U.S.A. 45459; (513) 435-7227

BIOLOGICAL TREATMENT OF CTMP WASTE WATERS

Chemi-Thermo Mechanical Pulping (CTMP) is a new and efficient process for the manufacture of wood pulp for pulp and paper industries. Fewer than 10 CTMP plants are in operation in N. America, with others being converted. Waste water from CTMP process has high BOD and resin acid concentrations, high influent temperature and high level of toxicity. This paper discusses the concepts involved in designing two full scale aeration systems for treating CTMP waste waters. Several aeration systems are evaluated. The factors that led to the selection of an efficient and cost effective method are discussed. Operating data is presented on two full scale plants.

COLTON, D.E; CURTIS, D.C; GREGSON, D.J; JERVIS, M.J. Sierra-Misco Environment Limited
830-D Pembroke Street, Victoria, Canada, V8T 1H9; (604) 381-4452

THE APPLICATION OF ADVANCED INFORMATION TECHNOLOGY TO THE MANAGEMENT OF WATER RESOURCES

Sierra-Misco employees over 60 specialists in the field of environmental monitoring, and has completed over 120 system contracts in many countries around the world. This paper describes the instrumentation technology, advanced telemetry and the central site computer hardware and software applied to these systems, and the opportunities to use advanced technology for improved water resource management and pollution control available to Asia-Pacific countries.

FAGAN, John D. John D. Fagan & Associates Pty. Limited
144 Jolimont Road, East Melbourne, Australia; (61) 3-650-6488

CENTRALIZED INDUSTRIAL WASTE TREATMENT: AN AUSTRALIAN PERSPECTIVE

Centralized treatment of industrial waste in Australia has become the normal procedure over the last decade. With a mixture of privately owned and publicly owned facilities the approaches taken in each city is a reflection of the State Government policy towards private enterprise playing a role in this industry. This paper reviews the processes and technologies employed, the types of wastes imputed, and the water quality and the environmental effect of the various facilities. In addition, both capital and operating costs are prepared for the various facilities.

FIESSINGER, Francois Zenon Environmental Incorporated
845 Harrington Court, Burlington, Canada, L7N 3P3; (416) 639-6320

ADVANCED WATER TREATMENT TECHNOLOGY

Water treatment technologies have undergone a relatively slow evolution in the course of the previous decades. It seems likely, however, that treatment technologies will change drastically within the next few years. This paper reviews the main technologies of water supply and waste water treatment. Projected changes are analyzed in the light of identified trends. Particular attention is given to emerging bio-reactors and membrane separation.

HARRIES, R. CH2M Hill Engineering Limited
600 - 180 Kings Street South, Waterloo, Canada, N2J 1P8; (519) 579-3500

DESALINATION OF BRACKISH SURFACE AND GROUND WATERS BY MEMBRANE PROCESSES

Membrane separation processes have been used extensively worldwide for the desalination of surface and ground waters. The type and configuration of the processes chosen vary and depend on site specific and design considerations. Site specific considerations include feed water supply characteristics, chemical and energy costs and operational factors. Design factors include the type of membrane process, membrane life and performance, array configurations and others. The potential for blending membrane system product with a by-pass should be considered to lower overall costs. This paper discusses site specific and design considerations for a number of reverse osmosis and electrodialysis reversal desalination plant installations. Pilot plant data and operating experiences are also described.

HAYES, P. ADS Services Incorporated
5490 Complex Street, Unit 603, San Diego, U.S.A. 92123; (619) 571-0045

SEWER COMPUTERS IDENTIFY GREAT SAVINGS PER WASTEWATER INFRASTRUCTURE PLANNING

Many of the world's wastewater collection systems are in a state of disrepair or lack sufficient capacity. An inexpensive and often overlooked way to assess the true conditions of a sewer system is through computerized sewer flow monitoring. One area where this methodology has proven particularly effective is in the detection of extraneous flows entering waste water collection systems. Inflow and infiltration (I/I) are two major components of extraneous flows which rob the system of much needed capacity. Using the city of Indianapolis, Indiana, as an example, this paper examines the benefits of computerized flow monitoring.

LEE, Ken B; BUIE, Bob; SMITH, Darwin UMA Engineering Limited
3030 Gilmore Diversion, Burnaby, Canada, V5G 3B4; (403) 486-7000

APPLICATION OF A G.I.S. SEWAGE SYSTEM MAINTENANCE

The city of Edmonton, like many other cities in North America, has been experiencing basement flooding and other problems as a result of excessive inflow and infiltration to sanitary sewer systems. This paper presents application of a micro-computer based G.I.S. in managing geographically oriented sewer information. The integrated G.I.S. data bases used to analyze the historical data, to interface with sewer flow simulation and to find a cost effective remedial works.

MCCONNELL, Hew D. Greater Vancouver Regional District
4330 Kingsway, Burnaby, Canada, V5H 4GB; (604) 432-6451

LIQUID WASTE MANAGEMENT IN GREATER VANCOUVER

The Greater Vancouver Regional District, with a population of 1.5 million, has just completed the first stage of a new master sewerage and drainage plan to meet the region's needs over the next 50 years. The plan considers sewage treatment upgrading, source control of industrial discharges to sewer, combined sewer overflows and stormwater management. This paper describes the open and co-operative process used for developing the plan, the options and costs for upgrading, and the key issues to be addressed in managing Greater Vancouver's wastewater.

MASSOLT, Peter R. A.P. van den Berg Machinefabriek B.V.
P.O. Box 68, 8440 AB Heerenveen, Netherlands; (31) 5-13031355

SUBSOIL POLLUTION MONITORING USING THE CONE PENETRATION METHOD

The cone penetration method is based on the principle that one can measure the resistance and friction of a cone shaped probe which is pushed into the soil at constant speed. The interpretation of these parameters can give a clear indication of the subsoil condition. The demand for a reliable and cost efficient method for in-situ determination of soil pollution verses traditional drilling encouraged A.P. van den Berg B.V. to develop two sophisticated probes for the environmental market. The first probe records tip load, friction, PH, conductivity, oxygen, hydrogen, redox potention, and temperature simultaneously. This lecture will include the presentation of the configuration of the system; the resolution factor, accuracy, and calibration method.

PIETRASANTA, Y; BONDON, D. Departement de l'Herault
Ville de Meze, France, 34140; (33) 67438767

THE NATURAL LAGOON AND OTHER NATURAL TECHNIQUES FOR THE PURIFICATION AND PROMOTION OF A SHELLFISH BREEDING AREA

This paper describes a unique methodology for dealing with urban and agricultural wastewater. The formation of a natural lagoon using micro and macrophytes, and anaerobie along with other processes have significant ecological and economical advantages when compared with a classical sewage farm. These advantages include microbial elimination, security, lower investment, lower exploitation costs and little or no use of energy or chemical products.

RANDALL, T.L; MEIDL, J.A; COPA, W.M. Zimpro/Passavant Incorporated
301 West Military Road, Rothschild, U.S.A. 54474; (715) 359-7211

TREATMENT OF CHEMICAL INDUSTRY PRODUCTION WASTE STREAMS BY THE PACT^R AND WET OXIDATION TREATMENT SYSTEMS

This paper covers the application of the PACT^R wastewater treatment system and wet air oxidation system, alone and in combination, to various waste streams. PACT^R stands for powdered activated, carbon treatment. The paper describes the two treatment processes as well as the important control parameters for each process. Waste streams that PACT^R effectively treats includes

1) run off from bulk chemical terminals;
2) pesticide production wastewater;
3) petroleum refinery wastewater;
4) organic chemical wastewater; and
5) caustic scrubbing liqueur.

REED, Doug W. Solarchem Environmental Systems
40 West Wilmot Street, Unit 5, Richmond Hill, Canada, L4B 1H8; (416) 764-9666

RAYOX: A SECOND GENERATION ENHANCED OXIDATION PROCESS FOR THE DESTRUCTION OF WATERBORNE CONTAMINANTS

The subject of this paper is Rayox, a powerful broad spectrum technology for the instream destruction of toxic and hazardous waterborne organic contaminants. The concept of enhanced oxidation is explained, along with the reasons for the significantly improved performance of second generation systems like Rayox. Examples of the destruction of a broad range of hazardous organic compounds such as PCB's, dioxins, TNT, chlorinated organics, nitrosamines etc., which have been treated in various process wastewater, groundwater and drinking water streams are provided. These results will help to illustrate why second generation enhanced oxidation systems like Rayox are fast becoming the treatment system of choice for destroying hazardous waterborne contaminants.

ROCCHINI, R.J. B.C. Ministry of the Environment
765 Broughton Street, Victoria, Canada, V8V 1X5; (604) 387-9502

THE PREPARATION AND APPLICATION OF WATER QUALITY CRITERIA AND OBJECTIVES FOR BRITISH COLUMBIA

For the past 30 years, the province has used a permit system to manage the discharge of waste to streams, lakes, and marine waters. More recently, as population and industry grows, we have found the need for new tools to protect water quality. Thus, over the past 5 years, the Ministry of Environment has begun to issue water quality criteria and objectives applicable to rivers, lakes and marine waters. Although water quality criteria and objectives do not have legal status, they are closely linked to the terms of the Waste Management Permit (WMP) used to manage discharges. These permits are the main legal instrument used to control water quality. This paper describes how criteria and objectives are developed and how they are linked to the preparation and enforcement of permits.

SAFI, Bechara F. SNC Research Corp.
#2 Place Felix-Martin, Montreal, Canada, H2Z 1Z3; (514) 866-6635

MULTIPLATE REACTOR APPLIED TO THE ANAEROBIC TREATMENT OF INDUSTRIAL WASTEWATER

This paper describes an anaerobic wastewater treatment facility that has been successfully tested at 1200 litres PDU scale for the anaerobic treatment of cheese factory wastewater. The reactor not only cleans the water, it produces a significant output of biogas on a daily basis. The advantages of this kind of bioreactor are detailed in the presentation.

SMITH, P.W. Solarchem Environmental Systems
40 West Wilmot Street, Unit 5, Richmond Hill, Canada, L4B 1H8; (416) 764-9666

MEETING THE AOX REDUCTION TARGETS WITH ENHANCED OXIDATION

The use of Canadian Enhanced Oxidation Technology designed to reduce toxic pulp mill effluence to the 1991 and 1994 AOX discharge level at reasonable cost is viewed. The environmentally friendly nature of the technology, as well as results from a practical demonstration in cooperation with a major eastern Canadian forest product company, suggests that an "everybody wins" solution may be available for companies which are facing this high profile problem. The coincident benefits of this proven technology, which can remove trace quantities of dioxins and can provide significant reduction in effluent colour while possibly avoiding the need for major bleach plant operational/process changes, are highlighted.

VIGERS, Gary A. et al E.V.S. Consultants
195 Pemberton, North Vancouver, Canada, V7P 2R4; (604) 986-4331

THE AEC BLEACHED CHEMI-THERMOMECHANICAL PULP MILL: A "GREENFIELD" CASE STUDY FOR SUSTAINABLE DEVELOPMENT

In October 1990 the Alberta Energy Company Ltd. (AEC) will be completing construction of a "Greenfield" 350 ADMTD BCTMP Mill located on the Lesser Slave River, Slave Lake, Alberta. The mill has designed and implemented pulping and processes that have no predictable persistent impacts from stack effluent emissions, using an 80% aspen based wood furnish. Approx. 8% of the total construction costs were allocated to the waste water treatment systems. A paradigm was presented in this paper to illustrate the relationship of sustainable development to the economic impact of pollution abatement strategy, and environmental monitoring programs on return on investment.

WALLACE, J.B; BIRKBECK, A.E; CHEN, W. B.C. Research Corporation
3650 Wesbrook Mall, Vancouver, Canada, V6S 2L2; (604) 224-4331

NITRIFICATION IN A FLUIDIZED ACTIVATED SLUDGE SYSTEM

The ammonia content of domestic sewage presents significant problems in receiving waters. In small scale systems, residence time and sludge concentrations may be insufficient to successfully remove ammonia from waste streams. The nitrification of domestic sewage was studied in a fluidized bioreactor system. The results of the testing program shows that the ammonia content of the feed stream could be effectively reduced by more than 75%. The treatment technology should lead to the application of the system in areas where space and economic restraints restrict waste treatment system sizes.

ZUKOVS, G; TOTH, C. CH2M Hill Engineering Limited
Plaza 3, Suite 100, 2000 Argentia Road, Mississauga, Canada, L5N 1V8; (416) 858-2320

ST. CATHERINE'S AREA POLLUTION CONTROL PLAN

The St. Catherine's Area Pollution Control Plan (SCAPCP) was initiated in order to develop a concentrated water management strategy for the St. Catherine/Thorold area of Ontario. The important issues that face these communities include: poor water quality, sewage overflow, basement flooding and the need for expansion of sewage collection treatment facilities. The paper will present the specifics of the pollution control plan developed for the St. Catherine's/Thorold area. Unique features of the plan will be highlighted.

STREAM F6
ENERGY AND AIR

BANNAI, M; SAKAI, M. Hitachi Limited
4-6 Canda-Surugadai, Chiyoda-ku, Tokyo 101, Japan; (81) 3-258-1111

FUEL REDUCTION SYSTEM OF DISTRICT COOLING AND HEATING PLANT FOR AIR ANTI-POLLUTION

Anti-pollution legislation in Japan has emphasized the need for reduction of thermal emissions from DCH (district cooling and heating) plants. This paper discusses the results of a feasibility study of the new DCH plant in Shinjuku, Tokyo, and emphasizes the energy savings and high efficiency as anti-pollution measures. Two main systems are used. The first is a Modified Topping System (MTS) which uses a back pressure turbine driven centrifugal chiller and an absorption chiller operated by secondary medium pressure steam. The second system is a gas turbine cogeneration unit, each with a capacity of 3,800 kW. The combination of these two systems improve the efficiency of the plant by more than 10%.

BECKER, E. Becker Verfahrenstechnik
7054 Korb, Federal Republic of Germany; (49) 07151-31058

LPS - LONG TERM PARTICLE SAMPLER: AN ISOKINETIC SAMPLING SYSTEM FOR CONTINUOUS MONITORING OF FLUE GAS EMISSIONS

In order to assess the separation efficiency of flue gas cleaning/filtering procedures and to continuously monitor the emission of particle-bound toxins from incinerated processes, sampling under strict isokinetic condition is mandatory. Within the scope of a research program "communal waste disposal", inaugurated at the nuclear research centre Karlsruhe, an isokinetic LPS was developed in collaboration with Becker Verfahrenstechnik. The sampling system design is strictly modular and incorporates a computer rated measurement and control circuit which guarantees isokinetic conditions. Even in stacks having low particulate concentrations, a sufficient quantity of particle samples can be collected in order to carry out heavy metal analyses or dioxin/furan analyses. This paper discusses the system in detail.

FRANK, Norman W. Ebara Environmental Corporation
Hempfield Industrial Park, R.D. #6-Box 516, Greensburg, U.S.A. 15601; (412) 832-1200

THE USE OF ELECTRONS FOR REMOVAL OF SO_2 AND NO_x FROM FLUE GAS

The electron-B process is one of the most effective methods of removing SO_2 and NO_x from industrial flue gases. This flue gas treatment consists of adding a small amount of ammonia to the flue gas and irradiating the gas by means of an electron beam, thereby causing reactions which convert the SO_2 and the NO_x to ammonium sulphate and ammonium sulphate nitrate. These salts may then be collected from the flue gas by means of conventional collectors such as electrostatic precipitators or a bag-house. Using actual test results, this paper identifies the many advantages this process has over currently used conventional processes.

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ENERGY AND AIR

BANNAI, M; SAKAI, M. Hitachi Limited
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BECKER, E. Becker Verfahrenstechnik
7054 Korb, Federal Republic of Germany; (49) 07151-31058

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FRANK, Norman W. Ebara Environmental Corporation
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HARMELINK, M.D; COLAVINCENZO, O.M.F. The Ontario Ministry of Transportation
Transportation Technology and Energy Branch, 1202 Wilson Avenue, Downsview, Canada, M3M 1J8; (416) 235-4441

THE DEVELOPMENT OF NATURAL GAS POWERED BUSES IN ONTARIO

In 1980, the Province of Ontario initiated a conservation and oil substitution program with the objective of reducing the consumption of oil. One of the outcomes of this program was the development and demonstration of natural gas powered buses. The development program was initiated by the demonstration of retro-fitted natural gas buses in Hamilton and expanded in 1988 to develop and demonstrate 50 natural gas powered buses. The buses will be demonstrated in Toronto, Hamilton and Mississauga and are expected to go into service in the latter half of 1990.

JEON, H.S; CHUN, W.G; et al Passive Solar Systems Research Laboratory
Korea Institute of Energy and Resources, P.O. Box 5 Daedeok, Daedeok Science Town, Dejeon, Korea; (82) 42-861-9700

FEASIBILITY AND PERFORMANCE STUDY ON EXPERIMENTAL INDIRECT SOLAR THERMOSYPHON SYSTEMS IN KOREA

This paper studies thermal performance of solar thermosyphon hot water systems designed to survive frigid weather conditions during winter in Korea. Theoretical analysis as well as on-site measurements are performed. Four different locations throughout Korea are chosen in order to gain field experiences and performance data for the system. Each system has two flat plate collectors of 4' x 8' in size connected in parallel. To extract more heat from the working fluid (ethylene-glycol), internal fins as well as special distributors are incorporated into its design.

KARAYANNOPOULOS, C.E; FILIPOVIC, D; VICEVIC, G.P. Union Carbide Canada Limited
Linde Division, 123 Eglinton East, Toronto, Canada, M4P 1J3; (416) 890-2611

CFCs RECOVERY, PURIFICATION AND REUSE TECHNOLOGY

The Linde Division of Union Carbide with support from the Ontario Ministry of the Environment has developed a novel CFC capture purification and recycling technology which could be potentially employed over a broad range of CFCs in both prompt and banked emission applications. CFCs are removed from discharge streams by adsorption onto an organophillic hydrophobic molecular sieve. The captured CFCs are in turn desorbed and recovered for reuse by an inert gas purge. A demonstration unit is being set up to verify the technology for recovering a broader range of CFC compounds.

LAO, Robert; EVANS, Bernard; HUSBAND, Stuart Radian Corporation
P.O. Box 201088, 8501 Mo-pac Boulevard, Austin, U.S.A. 78720 -1088; (512) 454-4797

ADDRESSING THE NEED FOR HIGH QUALITY, REPRESENTATIVE AMBIENT AIR QUALITY DATA IN SUPPORT OF CONTINUED ECONOMIC DEVELOPMENT IN TAIWAN, CHINA

Over the past few decades, environmental protection has not kept pace with economic growth in Taiwan. To remedy this problem, Taiwan set up the Environmental Protection Administration in 1987. One of the main concerns of the EPA was the degradation of air quality on the Island. In March of 1988, the EPA contracted with Radian Corporation to review and plan an air quality monitoring network for the entire island of Taiwan. This paper discusses the air quality issues in Taiwan, the resulting plans of the island wide air quality monitoring network and the future plans of Taiwan to procure and implement the network.

LEE, T.K; KIM, W.B; et al Korea Institute of Energy and Resources
P.O. Box 5, Daedeok Science Town, Daejeon, Korea; (82) 0478619700

OPTICAL CHARACTERISTICS OF ELECTRODEPOSITED BLACK CHROME SOLAR SELECTIVE COATINGS

This paper reports solar absorption and total hemispherical emittance properties of black chrome solar selective coatings using two different bath solutions and two different electrodeposition methods. The first bath solution consists of chromic acid, fluosilic acid and additive and has been used to deposit black chrome selective films on Nickel substrate employing the DC method (DCM). The second chromic acid-propionic acid bath solution has been prepared and coated on Copper plate using the pulse current electroplating method (PCEM). Optical properties and characteristics of electrodeposited films obtained by DCM and PDEM with both solutions have been compared.

LEIKVANG, Per Elkem Technology
P.O. Box 40, Vaagsbygd, 4602 Kristiansand S, Norway; (47) 4214000

THE NEW TRENDS IN AIR POLLUTION CONTROL AND ECONOMIC WASTE MANAGEMENT

Elken is the world's largest producer of ferro alloys and is a major producer of aluminum. Elken's recent efforts in pollution control have resulted in the development of the new trend in bag filtration. This is a return to the bag-house concept, judged obsolete over ten years ago. The new Elken technology allows high temperature processes with the most difficult dusts and gases being controlled in a safe and economical way. This paper will present the history and the technological results of the Elken effort, which allows the management of difficult effluents, the treatment of hazardous and toxic industrial waste, as well as the economic reward of applied research for utilization of waste materials.

MYREN, A.T. Energy and Environmental Measurement Corporation
Intermountain Ambient, 1315 S. Central, Unit C, Kent, WA, U.S.A. 98032; (406) 859-8359

WOOD STOVES REVISITED: A DISCUSSION OF THE POTENTIAL REDUCTION IN ENVIRONMENTAL IMPACTS, FUEL USE AND FUEL COSTS OBTAINED FROM WOOD HEATERS THAT COMPLY WITH THE U.S. E.P.A.'S NEW SOURCE PERFORMANCE STANDARDS

This paper looks at wood stove combustion from four perspectives:
1) historical;
2) current developmental methods;
3) assessment of probable environmental impacts from complying units; and
4) a look to the future of present wood combustion technology and its possible applications in other nations where wood is heavily relied upon as a fuel for heat and cooking.

PEDEN, William G. President, Environmental Corporate Services
30 Arundel Avenue, Toronto, Canada, M4K 3A2; (416) 465-2718

ENVIRONMENTAL/EFFICIENT TECHNOLOGY IN INDUSTRIAL PROCESSING

Environmental Corporate Services has assessed domestic and international technology options for technical, economic, commercial and environmental suitability to current industrial processes. The environmentally friendly technologies which have been identified include process heat recovery, "Expert System", process control, electromagnetic heating and others. This paper discusses new generation technologies, their uses in industrial commercial processes and the technical, economic and environmental benefits.

SANO, F. Babcock-Hitachi K.K.
6-2, Ohte-macht, 2-Chome Chiyoda-ku, Tokyo 100, Japan; (81) 3-270-1202

ADVANCED AIR POLLUTION CONTROL TECHNOLOGY

This paper introduces an advanced SO_x and NO_x removal technology developed and marketed by Hitachi and Babcock-Hitachi as part of flue gas treatment. These systems are low cost and resource saving, with proven reliability and capable of long term operation. The SO_x removal system, namely the wet limestone-gypsum process, is an integrated system combining the functions of prescrubbing, absorption, and oxidation in a single tower. The process is simple and produces a reusable by-product, gypsum. The NO_x removal system utilizes the plate type catalyst, which has been shown through accumulated experience to be adaptable in various applications.

SORENSEN, Bent COWIconsult
Teknikerbyen 45, DK2830 Virum, Denmark; (45) 45-45-97-22-11

ENVIRONMENTALLY ACCEPTABLE ENERGY FUTURES

The serious demands that are being made upon human activity by the environmental crisis will witness a major change in the attitudes of people over the next few decades. These changes will be dramatic, especially in terms of our energy use and the development of urban centres. It is expected that a combination of urban decentralization and growth in renewable or sustainable energy options will take place. Present forms of energy, particularly fossil fuel and nuclear energy may have to be phased out. This paper deals with the implications of such a paradigm shift.

TAKAKU, Yo Nippon Kokan
Environmental Control Department, 1-1-2 Marunouchi, Chiyoda-ku, Tokyo 100, Japan;
(81) 3-212-7111

THE PROGRESS OF ENVIRONMENTAL PROTECTION IN NKK AS A STEEL MANUFACTURER

NKK's Keihin steel works is located in the highly populated Keihin industrial district which includes the cities of Tokyo, Yokohama and Kawasaki. Strict pollution control legislation passed by the municipalities has encouraged NKK to apply the latest techniques and systems to environmental protection. These include SO_x reductions, NO_x reductions, recent cleaning and recirculating of waste water, and the application of continuous casting in place of conventional casting. These methods were successful in reducing emissions and also saving considerable amounts of energy which in turn contributed to the reduction of CO_2 generation.

TAMAURA, Yutaka Tokyo Institute of Technology
Department of Chemistry, Ookayma, Meguro-ku, Tokyo 152, Japan; (81) 3-726-1111

COMPLETE DECOMPOSITION OF CO_2 INTO C WITH THE ACTIVATED MAGNETITE

The purpose of this paper is to explain the decomposition reaction of CO_2 into C and 0^{2-} with an efficiency of 100%. This reaction will be usefully applied to the CO_2 removal in automobile exhaust gas to assist in relieving the global warming problem. This is the first report on the decomposition of CO_2 into carbon with nearly 100% efficiency at only 300° Centigrade.

TURKSON, A. Albarrie Canada Limited
85 Morrow Road, Barrie, Canada, L4N 3V7; (705) 737-0551

PARTICULATE EMISSION CONTROL WITH P84 COMPOSITE FABRICS IN DUST COLLECTORS

P84 fibres are manufactured by Lenzing AG of Austria. In fabric form the spaces between P84 fibres are much narrower than those found in many other fabrics. The result is very high separation efficiency and low pressure drop due to the predominance of surface filtration. In a series of studies, Albarrie learned that only the uppermost part of the P84 fabric structure was responsible for removal of particles. Albarrie has exploited this discovery by developing P84 composite fabrics comprised of P84 on different substrates. The result has been less expensive products which generate higher air flow compared to 100% P84. This paper includes 1) a comparison of particle removal characteristics of P84/polyester and 100% polyester fabrics 2) case histories in several industries.

POSTER SESSIONS

ANDERSON, R.L. Superlock
P.O. Box 3031, Langley, Canada, V3A 4R3; (604) 576-6611

ENERGY CONSERVATION IN BUILDING TECHNOLOGY

Superlock International Inc. is a Canadian research and development company dedicated to the design and implementation of systems and processes to enhance man's environment. This presentation identifies and details various technologies that are used to improve the air flow and the heating and the cooling capacity in buildings. Superlock has built and tested an ultraefficient, low cost, air to air heat exchanger and air management system. They have also developed a prefabricated wall system which provides a very effective environmental barrier.

BAJARD, Yves First Watercount Systems Ltd
595 West 24th Ave., Vancouver, Canada, V5Z 2B5; (604) 876-2440

WATER SIMULATION AND RELATED RISK ASSESSMENTS: THE DIFFERENCE IN REQUIREMENTS BETWEEN THE CLASSICAL SUPPLY ORIENTED CONTEXT AND THE NEEDS ORIENTED FRAMEWORK INDISPENSIBLE TO SUSTAINABLE DEVELOPMENT

This poster presentation describes water simulation and hydroenvironmental risk assessment systems that have been developed by First Watercount Systems. The purpose is to forecast water resource availability, quality and likely environmental and economic impacts of upstream activities on the downstream areas.

BIRKBECK, A.E. B.C. Research Corporation
3650 Wesbrook Mall, Vancouver, Canada, V6S 2L2; (604) 224-4331

RECIRCULATION SYSTEMS FOR FISH HATCHERIES

At a fish hatchery in the lower Fraser Valley, available ground water supply necessitated extensive water recycling within the hatchery. Recycling also minimized volumes of water for treatment prior to discharge. The water recycle system developed by B.C. Research was based on the rapid removal of fish feces and unutilized fish food, with minimal degradation of protein into soluble toxic ammonia nitrogen. The system provides 100% removal of ammonia nitrogen. Recent developments in water recirculation design are presented in this session.

BUDILOVSKII, Julii Litstankoproject Scientific Production Association
Vilnius, Lithuania

TECHNOLOGY AND EQUIPMENT FOR INDUSTRIAL WASTEWATER TREATMENT EMPLOYING WASTE METAL

This presentation introduces a novel wastewater treatment technology for water contaminated with compounds of heavy metals, dyes, traces of waste oil, and other pollutants. The technology uses a coagulent obtained from waste metal by electrolysis to replace lime, sodium bisulfate or ferrous sals.

CURRIE, Anne Ministry of Energy, Mines and Petroleum Resources, Province of B.C.
Parliament Buildings, Victoria, Canada, V8V 1X4; (604) 356-2195

MINE DEVELOPMENT REVIEW PROCESS

The mine development review process (MDRP) is the Province of British Columbia's comprehensive review procedure for the review and approval of all proposed coal and hard rock mineral mines. British Columbia's process is a successful model for integrating environmental, engineering, socio-economic financial and permitting factors in decision-making for sustainable development. The MDRP has been recognized by the World Commission on the Environment and Economy as making a significant contribution to sound decision making concerning sustainable development.

DAVIES, G.J. Hosakawa Micron Ltd
1940 Steeles Ave. E., Bramalea, Canada, L6T 1A7; (416) 791-3883

DRY FUME TREATMENT SYSTEM FOR ANODE BAKING FURNACES

In 1984 a fume treatment system for anode baking furnaces was developed by Hosakawa MikroPul with a new indirect gas cooler. The main target was to eliminate the evaporative gas coolers which required high maintenance because of corrosion and sour condensate drop out. The Hosakawa system has four main advantages. 1) It has very stable cooling capability. 2) High collecting efficiencies on tar, dust and fluoride. 3) Low overall maintenance. 4) Very stable operation under varying furnace conditions.

DAVIS, Joe Omega Geophysics Ltd
620 - 1033 Davie St., Vancouver, Canada, V6E 1M7; (604) 685-7867

REMOTE SENSING OF CONTAMINATION USING ELECTROMAGNETICS

Geophysical surveys are especially useful in the initial site characterization stage of a remediation project. Contaminants generally have electrical properties that differ from their host strata. This allows them to be traced by inductive electromagnetic surveys. It has the capability of locating ground water contaminants of five parts per million concentration and can detect hydrocarbons lying on a water table a few inches thick. This presentation details and explains electromagnetic use in sensing contamination.

DYKES, Robert Radian Corporation
8501 Mo-Pac Blvd., P.O. Box 201088, Austin, U.S.A., 78720-1088; (512) 454-4797

VOC & PM EMISSIONS SPECIATION DATABASE

The U.S. Environmental Protection Agency has several activities that require speciated particulate matter (PM) and volatile organic compound (VOC) profiles for common air pollutant emission sources. This Poster Presentation describes the speciation profiles and presents the methodology used to develop the speciation profiles. The paper will characterize the profiles with respect to a number of profiles available, the range of emission sources covered, and the other data stored on each profile. The paper also discusses how to obtain the speciation profile data base and available sources for user information such as user manuals and technical reports.

FARLEY, D.W. Environment Canada Inland Waters Directorate
Water Management Systems Division, Ottawa, Canada, K1A 0H3

INDUSTRY/GOVERNMENT COLLABORATION IN THE DEVELOPMENT AND APPLICATION OF ADVANCED WATER MANAGEMENT MODELS

Over the past fifteen years, the government of Canada and various industries have collaborated on the development of water management models including access to super computer facilities. Present day computational power of computers and continuously decreasing costs per computational cycle and permit more sophisticated solutions to the point where modelling integrity should no longer be sacrificed in the interest of reducing computational costs or execution time. This presentation outlines and explains some of the numerical models that have been developed.

FINKLER, Harald W. Department of Indian Affairs and Northern Development
Les Terrasses de la Chaudiere, Ottawa, Canada, K1A 0H4; (819) 997-9666

THE NORTHERN SCIENTIFIC TRAINING PROGRAM: A CANADIAN RESPONSE TO BUILDING A CRITICAL MASS OF POLAR EXPERTISE

The Northern Scientific Training Program, funded by the Department of Indian Affairs and Northern Development, provides supplementary funding to approximately 300 students annually, at over 30 universities across Canada, for projects in any field of inquiry in the social, physical, life or applied sciences as long as the research has an essential orientation to the Canadian north. This poster project describes the Northern Scientific Training Program and demonstrates how universities have been encouraged to develop a northern studies focus.

FREY, Patrick R. Ministry of Municipal Affairs, Recreation and Culture, Province of B.C.
333 Quebec St., Victoria, Canada, V8V 1X4; (604) 356-1196

REHABILITATION AND REUSE OF HERITAGE: CHALLENGES AND OPPORTUNITIES

As we approach the turn of the century and the public becomes more sensitive to the linkages between "conservation" and "sustainable development", wasteful mismanagement of our built environment be increasingly unacceptable. Changing attitudes combined with other economic and social factors will create new opportunities for heritage rehabilitation throughout North America. This presentation provides information on the magnitude of rehabilitation investment and its contribution to our economy and the character of our communities.

GOLDSTEIN, MICHAEL J.; DAVIS, GERALYN Soilcon Laboratories Ltd
105 - 2931 Olafson Ave., Richmond, Canada, V6X 2R4; (604) 278-5535

THE ENVIRONMENTAL MONITORING PROGRAM FOR THE GREATER VANCOUVER REGIONAL DISTRICT MUNICIPAL REFUSE INCINERATOR

The Greater Vancouver Regional District constructed a municipal refuse incineration facility designed to incinerate approximately 20% of the municipal solid waste generated within the metropolitan area of Vancouver. As part of the monitoring program soil and vegetation have been sampled for metals and PAH's in 1987, prior to the commissioning of the incinerator and during two years of operation. The design and ongoing review of the soil and vegetation monitoring program is unique in the province.

HARRISON, Ruth; JOHNSON, D.L. TYDAC Technologies Inc
1600 Carling Ave., Suite 310, Ottawa, Canada, K1Z 8R7; (613) 722-7472

MODELLING THE GEOGRAPHY OF IMPACT OF CLIMATE CHANGE ON GRASSHOPPER OUTBREAKS

Using the Spatial Analysis System from TYDAC Technologies Inc., a simple geographical information system (GIS) model was developed to determine the spatial correlation of grasshopper distribution to the shift in climatic patterns of temperature and precipitation as indicated in the current climate change models. Annual maps of the log of grasshopper population density in Alberta for the years 1970 - 1989 were compared to maps of weather variables. An overlay model based on empirical and biological relationships was developed to predict the future insect distribution, based on the predictions of current global circulation models.

HAYMAN, G.D.; MacDONALD, C Harwell Laboratory
Environmental Pollution Research Centre, Building 329, Oxfordshire, U.K., OX11 ORA; 44-235-432-882

REGIONAL AND GLOBAL ATMOSPHERIC POLLUTION STUDIES

The Environmental Pollution Research Centre at the Harwell Laboratory has established a reputation in studying regional and global atmospheric pollution problems. The facilities and expertise present allow sophisticated modelling and assessment studies to be undertaken which are backed-up by relevant field and laboratory measurements. This presentation illustrates the role of the centre in these areas with selective and relevant recent results, especially on global warming, stratospheric ozone depletions, photochemical oxidant formation and acid rain.

HENRY, David AGRA
401 - 12 York St., Ottawa, Canada, K1N 5S6; (613) 237-7074

SERVICES OFFERED BY AGRA INDUSTRIES LIMITED/HARDY BBT LIMITED

This poster display covers the following environmental services offered by Hardy BBT Limited: hydrogeology, hydrology, forestry, limnology, air monitoring, environmental inspection and audits, land reclamation, contaminants, environmental chemistry and environmental engineering.

HUTTUNEN, Martti Savcor Consulting Inc
200 - 1130 West Pender St., Vancouver, Canada; (604) 662-7034

ELECTROCHEMICAL PROTECTION SYSTEM CUTS CORROSION RATES IN PULP MILL EQUIPMENT

This paper presents the forms of corrosion indigesters and impregnable vessels. The influence of different process parameters on the risk of local corrosion is reviewed. Electrochemical protection systems have reduced the corrosion rates for digesters, impregnator vessels, bleaching plants, tanks and clarifiers resulting in longer equipment life and increased productivity. Further, the systems are automatically controlled and the operations can be monitored totally remotely. Benefits can be realized quickly, through reduced maintenance costs and increased production rates due to less down time. Pulp mill equipment with electrochemical protection systems will eliminate leakage of hazardous liquids, thus minimizing the environmental risks.

IKEDA, Komichi Environmental Research Institute
Suite 304, 5-6-16 Kita-Shinagawa Shinagawa-Ku, Tokyo, Japan, 141; 81-3-444-2514

PREDICTION OF AUTOMOBILE EXHAUST GAS (CO_2) IN THE GREATER TOKYO AREA

This paper predicts the increase of automobile exhaust gas (CO_2) in the greater Tokyo area by means of micro computer model simulation. The computer model considers approximately 2500 lengths of freeway and highway network in the greater Tokyo area and 25 social and economic indices. Under varying growth patterns, the amount of CO_2 generated by the city of Tokyo will increase substantially between now and the year 2000. The concentrations in specific areas will also increase dramatically.

JAMIESON, W.D.; BERMAN, S.S. Marine Analytical Chemistry Standards Program
National Research Council, Halifax, Canada, B3H 3Z1; (902) 426-8279

TOWARD MORE RELIABLE ENVIRONMENTAL ANALYSES: THE USE OF REFERENCE MATERIALS

Since 1976, the National Research Council of Canada has operated the Marine Analytical Chemistry Standards Program (MACSP), established in support of analytical chemistry aspects of marine chemistry. The overall goal of the MACSP is to improve the reliability of analytical chemistry data produced for marine science and engineering, and for the management of marine resources. This presentation describes MACSP plans and activities and the use of reference materials to assure the quality of environmental analytical chemistry data.

JOHNSON, Robert L. Canadian Biosonics Ltd
Chilliwack, Canada; (604) 792-8587

HYDROACOUSTICS: FISHERIES TOOL FOR THE '90s

The application of fisheries acoustics techniques has become increasingly important in fisheries research and management over the past two decades. With increased sophistication in scientific echosounders and micro computer based echo signal processors, the science of hydroacoustics will play an increasing role in management of fisheries. Fisheries acoustics has distinct advantages over traditional sampling methods, including: higher efficiency; less selectivity; less impact on the target population; and improved data processing.

KANSAS, John; RAINE, R. Michael Beak Associates Consulting Ltd
#260 - 2635 - 37th Ave. NE, Calgary, Canada, T1Y 5B7; (403) 291-5080

THE GREATER JASPER ECOSYSTEM CARIBOU RESEARCH PROJECT: A CONSERVATION STRATEGY IN ACTION

The Greater Jasper Ecosystem Caribou Research Project provides an example of how the principles of the Alberta and World Conservation Strategies are being employed to develop a much needed framework for the management of an endangered species. An ecosystem approach is being undertaken for the study and management of caribou that routinely cross provincial and national park boundaries. Research data is being used to develop an interagency data base, available to federal and provincial governments, industry, and non government organizations to help develop a truly integrated management plan for caribou.

KHUBCHANDANI, Shyam Transport Canada, Research and Development
Place de Ville, Ottawa, Canada, K1A ON5

THE IMPLICATIONS OF LONG TERM CLIMATIC CHANGES ON TRANSPORTATION IN CANADA

The long term climatic changes in Canada due to the "Greenhouse Effect" are expected to be significant: 4 to 7° C increase in average temperatures at higher latitudes, about 1m rise in sea levels and 0.5 to 1m fall in Great Lakes water levels. These changes would impact greatly on human activities and the resulting demand and supply for transportation. The northward extension of settlement patterns would require major expansion of transportation infrastructure services. This presentation explains some of the major impact of global warming on several sectors of the environment/economy mix.

LAWRENCE, Ted Department of Indian Affairs and Northern Development
Ottawa, Canada, K1A 0H4; (819) 994-7454

ENVIRONMENTAL MONITORING OF THE NORMAN WELLS PIPELINE

In March, 1981, the National Energy Board approved the construction of the 869 km long Norman Wells Oil Pipeline from Norman Wells, Northwest Territories, to Zama, Alberta. Subsequently, a cooperative government/industry monitoring program was developed to evaluate and mitigate the effects of the pipeline construction and operation on terrain. This presentation describes and explains the monitoring procedures and the effectiveness of the program in fostering cooperation between government and industry to minimize the impact of this pipeline project on permafrost terrain.

MACKAY, David Ove Arup and Partners
56/F Hopewell Centre, 183 Queens Road East, Hong Kong; 5-283031

COASTAL AQUACULTURE, THRIVING INDUSTRY, ENVIRONMENTAL THREAT

The coastal rearing, in pens, of carnivorous fish, notably salmonids, has resulted in several negative impacts on ecological systems. These problems relate to disease, parasites, hypernutrification, and blanketing of the sea with organic wastes. Other problems arise through overuse of therapeutic drugs, damage to wild stocks from genetic manipulation, and adverse affects on bird and mammalian predators from over zealous control. This paper reviews the benefits and problems of aquaculture in coastal waters and proposes methods for reconciling conflicting priorities to provide optimum management of a valuable resource.

MADHUR, Jaswinder MacDonald Dettwiler
13800 Commerce Parkway, Richmond, Canada, V6V 2J3; (604) 278 3411

SPACE BORN ENVIRONMENTAL MONITORING IN THE 1990s

MacDonald Dettwiler has been in the business of developing satellite data processing systems since 1969. The company has installed a base of data acquisition sites now form part of a global network dedicated to the delivery of accurate and timely satellite information to environmental researchers and decision makers worldwide. This paper, using applicable examples, illustrates how remote sensing tools provide policy makers and planners reliable cost effective environmental information on global, national and regional scales for effective resource management and development.

MARTIN, Jim; O'NEIL, Kevin Aberta Environment
9820 - 106th St., Edmonton, Canada, T5K 2J6

ALBERTA'S PROGRAMS IN WATER EDUCATION

Alberta Environment has been a major sponsor of educational programs for 15 years. A major area of emphasis in the department's programs has been on water, its management and protection. This poster presentation describes and explains some of the various programs that Alberta Environment is involved with including: The Water Literacy Program; The Aquatic Invertebrate Monitoring Program; Water in Alberta: the Living Flow; The "Adopt a Stream" Program.

MCCANDLESS, John Lytton and Mt. Currie Indian Peoples
Box 1420, Lilloet, Canada, V0K 1V0; (604) 929-5550

GLOBAL CONFERENCE ON INDIGENOUS PEOPLES AND THE ENVIRONMENT

The poster presentation describes the above noted conference to be held in August, 1991. The conference focuses on the urgent need for all nations and countries to come to "one common mind" if humankind is to preserve and sustain the environment.

METTING, Blaine; FLEMMING, D.L. Enviros Corporation
600 Skyline Tower, 10900 NE 4th St., Bellevue, U.S.A., 98004; (206) 455-2962

BIOPROCESSES FOR INDUSTRIAL WASTE MINIMIZATION

Enviros Corporation has developed and applied waste stream - specific degradation and detoxification bioprocesses for the treatment of waste water. Microbial processes proceed courtesy of catalytic enzymes and enzymatic systems capable of exploitation by industry. These bioprocesses are contained within physical systems called bioreactors that permit optimization of process parameters. There are a series of bioreactor parameters which determine the effectiveness of any particular bioreactor system. These vary from reactor design to the type of micro-organisms used, to cost alternatives and comparison with present solutions to waste problems. This presentation focuses on the importance of obtaining answers to these and related questions and suggests how they might be answered in a manner cognisant of technical possibilities and limitations.

MICHELSON, David; LANZINER, Helmut; ASPLIN, David University of British Columbia
Department of Electrical Engineering, Vancouver, Canada, V6T 1W5

APPLICATION OF ELECTRONIC CHART SYSTEMS IN THE PREVENTION OF SHIPS GROUNDING

The combination of Electronic Charts and Display System (ECDIS) with Integrated Navigation Systems (INS) has recently been described as "the most revolutionary advance in marine navigation" since the introduction of the paper chart several hundred years ago. ECDIS/INS systems automatically process the data provided by various navigation instruments carried aboard ship and present the results in real time on a high resolution colour graphics display that shows the ships location and course with respect to the shore line. The system can be programmed to display warnings and trip alarms when it senses the vessel is off course or approaching an navigational hazard.

MUNKITTRICK, K.R. E.V.S. Consultants
195 Pemberton Ave., North Vancouver, Canada, V7P 2R4; (604) 986-4331

THE USE OF FISH POPULATION CHARACTERISTICS TO DIRECT AN ASSESSMENT OF THE HEALTH OF AQUATIC ECOSYSTEMS

E.V.S. Consultants has adapted a framework entitled PISCES (Population Indicators of Sublethal Contaminant Effects on Suckers) which uses fish population characteristics to direct research efforts and addresses the need for simple methodologies to aid in the assessment of contaminant impacts on wild fish populations. PISCES provides a framework for relating individual and population effects to the duration of exposure and the reversibility of observable effects. This presentation describes the process and value of PISCES.

NICKEL, RICHARD, A. Waste Management Branch, Ministry of Environment
Province of British Columbia, 3547 Skaha Lake Rd., Penticton, Canada, V2A 7K2; (604) 493-8261

THE OKANAGAN BASIN AS A SENSITIVE ENVIRONMENTAL AREA

The Okanagan Valley, in British Columbia was declared a sensitive environmental area by the Provincial Government in 1985. The government also provided funds and resources to upgrade and construct new treatment works, and give additional direction to develop a control strategy for septic tanks, agricultural practices, and forestry operations. At the termination of this project, the Okanagan will have some of the most sophisticated treatment and disposal systems found anywhere in the world. This presentation describes the processes and technologies that are being used to protect the Okanagan Basin.

PILON, Paul; WIART, Raoul Province of British Columbia, Ministry of Forests
Inventory Branch, Remote Sensing Section, 1450 Government St., Victoria, Canada, V8W 3E7; (604) 387-5262

OPERATIONAL FOREST INVENTORY UPDATING USING LANDSAT TM DATA: THE BRITISH COLUMBIA EXPERIENCE

The Inventory Branch, British Columbia Ministry of Forests, has a mandate to update the provincial forest inventory database which consists of over 6600, 1:20,000 scale map sheets. Updating a database of this size using conventional photo interpretation and manual drafting is time consuming and costly. Digital satellite remote sensing techniques using Landset TM data integrated with CAM/GIS technology have provided an efficient and cost effective method of streamlining the update procedure. This paper describes how such technology is currently being used operationally in B.C.

SMITH, William Science Council of Canada
100 Metcalfe St., Ottawa, Canada, K1P 5M1; (613) 992-7850

HARNESSING SCIENCE AND TECHNOLOGY FOR COLD REGIONS

The Canadian North is littered with the unforseen or uncontrolled consequences of technologies transferred into a harsh environment without due regard to the problems imposed by the cold. While Canada is already a leader in cold region technology, much remains to be learned. The Science Council statement, Harnessing Science and Technology for Cold Regions, makes ten recommendations for research and infrastructure development.

SOPUCK, Robert D. Sustainable Development Coordination Unit - Manitoba Government
305-155 Carlton Street, Winnipeg, Canada, R3C 3H8; (204) 945-1124

CONSERVATION AS A STIMULUS FOR RURAL ECONOMIC DEVELOPMENT

The prairie and aspen parkland regions of Western Canada have been greatly modified by human settlement and agriculture. Soil erosion and the loss of wildlife habitat and species are becoming serious problems that must be addressed. Conservation programs must also deal with economic problems that exist. The balance between the necessity of a healthy environment and appropriate economic activity is difficult to strike but certainly possible. This presentation offers several solutions.

STEWART, R. Stewart/Trumble Research Associates,
P.O. Box 1327, Port Alberni, Canada, V9Y 7M2; (604) 724-0565

ENVIRONMENT 2000 POLLING STRATEGY

Stewart/Trumble Research Associates have developed an innovative polling technique designed to include governments, industry, interest groups and the general public directly in the environmental decision making process. This process, called Environment 2000, is a public assessment forum which addresses specific environmental issues on an individual basis. This poster session describes the process an its value.

TIMMENGA, H.J. B.C. Research Corporation
3650 Wesbrook Mall, Vancouver, Canada, V6S 2L2; (604) 224-4331

COMPOSTING OF FISH WASTES: A SOLUTION FOR MORT DISPOSAL IN AQUACULTURE

One of the major problems facing the aquaculture industry in British Columbia is disposing of the dead fish, called morts, which fall to the bottom of the pens. Every three to five days, these pens are cleaned of morts and the carcasses are stored in bins for pick-up. Since the morts are not fresh, they are not suitable for processing into feed products, including fish meal. Alternate disposal options, including silage, rendering, incineration, ocean dumping, and composting are being used. Most of these disposal options have serious drawbacks. One of the best ways of eliminating fish wastes is composting the morts along with wood chips, sawdust or peat. The produced compost is a stable, rich product that could be used in nurseries, home gardens and in parks systems.

VIGERS, G. A.; FARRELL, A. P.; JANG, D. M.; MORGAN, J. D. E.V.S. Consultants
195 Pemberton Ave, North Vancouver, Canada, V7P 2R4; (604) 986-4331

GAUGING THE RELATIVE SENSITIVITY OF ACUTE LETHAL AND SUBLETHAL TOXIC RESPONSES IN FISH

The relative sensitivity of threshold acute lethal and sublethal responses of fish to pollutants is affected significantly by time-concentration conditions forced by test conditions, which seldom reflect the time-concentration conditions occurring in situ. Research is presented describing experimental and mathematical approaches to estimating equivalent toxicity factors to establish baseline values for relative sensitivities to address these shortcomings.

WILCOX, J.; SUNDQUIST, J., et al Ecology and Environment Inc
368 Pleasant View Dr., Lancaster, U.S.A., 14086; (716) 684-8060

LOGISTICS OF THE PRELIMINARY DESIGN OF A WASTE TREATMENT PROGRAM AND SECURE LANDFILL IN SHENYANG, CHINA

In March 1988, Ecology and Environment Inc. began an extensive feasibility study to develop a detailed technical approach for hazardous waste treatment, storage, and disposal for the city of Shenyang, People's Republic of China. Many elements both common to the United States an unique to China were confronted while examining the logistics of this project. This presentation details the distinct aspects in developing a preliminary design for a waste treatment program and secure landfill in Shenyang.

WILSON, R.C.H.; SMILEY, B.D. Department of Fisheries and Oceans, Institute of Ocean Sciences Sidney, Canada; (604) 356-6335

CONFIDENCE IN ENVIRONMENTAL DECISIONS - EVALUATING THE DATA

Since 1979 the Institute of Ocean Sciences has been developing a computer and report based inventory of all known oceanographic data in the Canadian Arctic and British Columbia marine waters. The system is a geographically based, multidisciplinary tool for finding information about currents, temperature, salinity, water levels, waves, hydrocarbons, metals, nutrients, bacteria, plankton, epontic organisms, zoobenthos, marine and anadronous fishes and marine mammals. Access to an interactive database may be arranged by contacting the authors.

WOOD, B.J.; SHORT, K.A.; SEEMAN, B. Bull, Housser and Tupper
3000 Royal Center, 1055 West Georgia Street, Vancouver, Canada, V6E 3R3; (604) 687 6575

POLLUTION, PATENTS AND PROFITS OR CLEANING UP WITH PATENTS

Increased governmental regulation of industry to protect the environment is inevitable. In spite of initial pessimism, such regulations can provide an opportunity for profit through patent protection since necessity is the mother of invention. The owner of the patent rights to an invention which enables an industry to meet the new regulations has a distinct competitive advantage. Pollution control inventions can lead to opportunities for industry to profit from recycling waste products, or producing valuable by-products for sale to others. This paper presents practical examples of companies who profit from pollution control technologies that were developed as a direct result of governmental regulation. The examples range from small, local companies who recycle common-place but difficult to dispose of items, to large mining corporations who profit from controlling their noxious emissions and extracting valuable by-products.

YIN, Yongyuan Simon Fraser University
Department of Geography, Burnaby, Canada, V5A 1S6; (604) 291-4558

DESIGN OF AN INTEGRATED ASSESSMENT FRAMEWORK FOR SUSTAINABLE LAND MANAGEMENT

"Sustainable" resource development has become a widely accepted concept in land management. This study of an actual site contributes to sustainable resource development in two aspects. First, an integrated date base for sustainable land use analysis is established to provide a basis for incorporating bio-physical and socio/economic information from various data sources. Secondly, an integrated analytical system is developed for assessing the implications for land use prospects/policies for sustainable land development. This analytical system coordinates the land assessment made by various land users and comprehends the interactions between these users.

YOUNG, Suzanne University of British Columbia
Room 217, Geography Building, 1984 West Mall, Vancouver, Canada, V6T 1W5; (604) 228-2663

PROBABILISTIC HILL SLOPE STABILITY PREDICTION METHODS USED IN BRITISH COLUMBIA: HOW WELL DO THEY WORK

In steep, perhumid terrain natural slope instability increases locally with logging and road building activities. Slope failures cause forest site loss, increased operating cost, and interfere with fishery resources. Consequently, there is scientific, environmental and operational forest management interest in identifying terrain subject to slope failure; specifically, terrain susceptible to clear cut land slide. This study illustrates an industry's attempt to integrate environmentally sensitive management with profitable business practices.

ZAKRAJSEK, S.; MACEK, J.; DOLENC,F. University Edvard Kardelj
74224 Gorenja vas, Ljubljana, Yugoslavia; 61-121-444

REDUCTION OF WASTE IN CLOSED CIRCUIT OF TECHNOLOGICAL WATER IN URANIUM ORE PROCESSING

The production of uranium concentrate from low content uranium ore gives an undesirable ratio between the product and the waste in this process (approximately 1:1000). In the case of the uranium mime, Zirovski vrh, which is in a heavily populated area and has certain unfavourable meteorological and geographical conditions, a closed circuit process for wastewater was developed and assembled. This presentation describes the process and success of the procedure to purify the water.